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Biofuels: The Impact of Oil Palm on Forests and Climate

May 12-13, 2009
Singapore

Sponsored by
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Conference Proceedings

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Acronyms

CEC	California Energy Commission
CO2	Carbon Dioxide
CPO	Crude Palm Oil
ELTI	Environmental Leadership & Training Initiative
EU	European Union
FAO	United Nations Food & Agricultural Organization
FPIC	Free, Prior & Informed Consent
GHG	Greenhouse Gas
IEA	International Energy Agency
IUCN	International Union for the Conservation of Nature
MYR	Malaysian Ringgit
NGO	Non-governmental organizations
NUS	National University of Singapore
OPEC	Organization of the Petroleum Exporting Countries
POTICO	Palm Oil, Timber and Carbon Offsets Program (World Resources Institute)
RCA	Responsible Cultivation Area
REDD	Reducing Emissions from Deforestation and Forest Degradation
RRS	Roundtable on Responsible Soya
RSB	Roundtable on Sustainable Biofuels
RSPO	Roundtable on Sustainable Palm Oil
UNFCCC	United Nations Framework Convention on Climate Change
US	United States of America
USD	United States Dollars
WRI	World Resources Institute
WWF	World Wildlife Fund

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Introduction

Dr. John David Neidel

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Biofuels have been widely touted in recent years as an environmentally-sustainable alternative to fossil fuels. Produced from plant materials that absorb CO2 from the atmosphere, they have been promoted by an array of governments through subsidies, tax cuts, and quotas as a way to reduce GHG, as well as achieve greater energy independence and increase farmers' incomes. The recent growth in the demand for biofuels has resulted in the widespread planting of biofuel feedstocks and the expansion of refining capacity.

Oil palm is considered by many in the industry as having great potential as a biofuel feedstock, because it is the most productive of the oil-producing plants and therefore excellent for making biodiesel. Today, the top producers of palm oil are Indonesia, Malaysia, Nigeria, and Thailand, which together account for almost 90% of production on a global scale, while China and India are the main importers. Only 5% of palm oil is currently used for biodiesel production, with the rest being used for food, cosmetics, skin care products, detergents and soaps, but the potential for further expanding palm oil production and diverting it to biodiesel production is great.

The ability of oil palm-derived biodiesel to contribute to GHG reductions, however, has come under severe criticism from environmentalists and concerned scientists. The area under oil palm cultivation has more than tripled over the last 40 years from less than 4 million hectares in 1961 to almost 14 million in 2006. They argue that oil palm production has expanded at the expense of tropical forests, the clearance of which has resulted in high level of GHG emissions, biodiversity loss, and the erosion of other ecosystem services, all of which have been particularly felt by indigenous peoples and rural communities. These negative impacts have led some to assert that the funds used to promote biofuels would be much better spent reducing deforestation, a larger source of GHG emissions than the entire global transportation sector.

The response from the palm oil industry to such charges linking oil palm production to forest degradation and climate change has been varied. Some industry players have launched public relations campaigns, challenging them on empirical grounds. Others have joined certification schemes, such as the RSPO and the RSB in attempts to ensure that biofuels and biofuel feedstocks are created in an environmentally and socially-friendly manner. However, viewed more cynically, these certification schemes also serve as a shield and divert at-

tention away from unsustainable industry practices. Still other actors have focused on the development of alternative non-edible, second generation feedstocks that can be grown on marginal lands.

The debate over oil palm as a biofuel feedstock remains very heated, in part because there are a number of important questions about the linkages between oil palm expansion, forest clearance, and climate change that remain unanswered or contested. These questions include:

- To what extent have tropical forests been converted or will be converted to expand oil palm production for biofuels?
- What factors determine the extent to which GHG emissions are reduced by using oil palm-derived biodiesel? How do biofuels compare to 'Avoided Deforestation' or REDD?
- What is the potential for second generation biofuel feedstocks, such as Jatropha and algae, to reduce negative environmental impacts associated with oil palm?
- What are the prospects for certification schemes to reduce negative environmental impacts of oil palm-derived biodiesel?

The conference ended with a final question—What additional steps can be taken to minimize the environmental impact of the palm oil and biofuels industry?—aimed at identifying possible solutions and ways forward.

To answer these questions, the conference organizers brought together scientists, industry representatives, social and environmental activists, policy makers, and alternative market entrepreneurs in order to share their perspectives. This conference was sponsored by the Environmental Leadership & Training Initiative (ELTI) and the National University of Singapore's (NUS) Department of Biological Sciences. ELTI is a joint program of the Yale School of Forestry & Environmental Studies and the Smithsonian Tropical Research Institute, whose mission is to enhance the capacity of decision makers and practitioners to conserve, restore, and mitigate threats to tropical forests. The ELTI- Asia office, which organized this conference, is based at the NUS Department of Biological Sciences.

Executive Summary

The Environmental Leadership & Training Initiative (ELTI) and the National University of Singapore (NUS) Department of Biological Sciences held the conference, **"Biofuels: The Impact of Oil Palm on Forests & Climate,"** from May 12-13, 2009 at NUS. The conference brought together scientists, industry representatives, social and environmental activists, policy makers, and alternative market entrepreneurs to share their perspectives on a series of key questions regarding the relationship between oil palm, forests, and climate. The conference started with a keynote address and was organized around five panels.

The keynote speaker for the conference was Dr. William Laurance of the Smithsonian Tropical Research Institute, who provided a general overview of the environmental issues surrounding biofuels production. According to Dr. Laurance, biofuels will likely play an increasingly important role in the future given concerns over limited fossil fuel supplies and energy security. The GHG emissions associated with biofuels are also becoming an equally important issue, given the threat of global climate change. The relative emissions of different biofuel feedstocks are greatly influenced by whether the production of the feedstocks results in direct or indirect natural habitat destruction. If they do, Dr. Laurance stressed, then the biofuel feedstock should not be grown. Other environmental factors need to be taken into account as well, including the role of forests in maintaining the hydrological cycle, stabilizing soils, and conserving biodiversity. When all these factors are considered, first generation biofuels like oil palm do not fare particularly well. There are a number of new technologies, including those focused on cellulose, that are coming on line soon and hold great potential.

Panel 1: To what extent have tropical forests been converted or will be converted to expand oil palm production for biofuels?

Dr. Kulyana Sundram of the Malaysian Palm Oil Council started this panel by explaining that the expansion of oil palm needs to be seen in the context of the growing world population and burgeoning demands for food. Oil palm is by far the most efficient of the oil producing crops in the world, producing more oil per unit of land than any other crop. By relying on oil palm, Dr. Sundram suggested, we are in fact saving other areas of land that would otherwise need to be converted for more yield. Dr. Lian Pin Koh from the Swiss Federal Institute of Technology Zurich addressed this point made by Dr. Sundram by examining research data from Malaysia which indicated that approximately 50% of oil palm expansion in the country had occurred at the expense of tropical forests - a situation similar to Indonesia. While some have suggested that oil palm plantations could be made more biodiversity-friendly through various management actions, Dr. Koh's research implied that the improvements would be marginal at best. Thus, Dr. Koh seconded the call by Dr. Laurance to protect existing forests, including those already degraded from logging. Mr. Fitrian Ardiansyah of the World Wildlife Fund (WWF) then provided information on a program that is aimed at identifying "responsible cultivation areas" (RCA) or degraded land where oil palm companies could expand without causing major environmental damage or impacting local communities in West Kalimantan, Indonesia. The need for such a program was made evident by the fourth speaker, Mr. Mark Bujang of the Borneo Resources Institute of Malaysia, who described the violations of indigenous peoples' rights by oil palm plantations in the Malaysian state of Sarawak as a result of the government's failure to recognize the full extent of their ancestral domain lands.

Panel 2: What factors determine the extent to which GHG emissions are reduced by using oil palm-derive biodiesel? How do biofuels compare to 'Avoided Deforestation' or REDD?

Dr. Daniel Murdiyarso from the Center for International Forestry Research started this panel, examining the amount of time needed to offset the carbon losses resulting from land use change for biofuel feedstock production by switching to oil palm-derived biodiesel. Converting grasslands to oil palm production has a pay-back time of 10 years, while converting forests on mineral soil takes about 75 years, and converting forests in peat land areas takes about 600 years. Thus, from a climate change perspective, it is clearly better to protect that land through the Reducing Emissions from Deforestation and Forest Degradation (REDD) mechanism than using it to grow oil palm. Dr. Lian Pin Koh then examined this comparison from a financial perspective. Based on a modeling exercise, he found that REDD cannot compete with oil palm on purely economic grounds unless REDD is approved for incorporation into regulatory markets where the price for carbon credits will likely be much higher. Mr. Ibrahim Rehman from The Energy and Resources Institute then discussed the development of the Roundtable of Sustainable Biofuels (RSB), which is trying to develop a set of standards and certification system that will cover all biofuel feedstocks. One of the questions that the RSB has had to contend with is the degree to which direct and indirect land use change is included in their calculations. One of the problems that emerged from his discussion is the fact that there is no standardized way to conduct a life cycle analysis, which allows for the entry of a fair degree of subjectivity into the calculations. The panel ended with a presentation by Mr. Jim McKinney of the California Energy Commission. Mr. McKinney explained that the United States of America's (US) state and federal policy drivers are going to bring about a large shift to low-carbon intensity fuels in the near future. While biofuels will have a role to play, palm oil is competing with innovative alternative technologies. Moreover, palm oil has a bad image related to environmental degradation that will have to be overcome if palm oil producers want to take advantage of this huge market opportunity.

Panel 3: What is the potential for second generation biofuel feedstocks, such as Jatropha and algae, to reduce negative environmental impacts associated with oil palm?

Mr. Tobias Garritt started this panel by reporting on Eco-Emerald's development of Jatropha plantations in the Indonesian province of Papua. He explained that they are developing this biofuel feedstock in a way which is environmentally, socially, and technically sustainable, as well as profitable for all stakeholders. This positive outcome, however, comes about because of the company's commitment to sustainability, rather than as a result of some intrinsic quality of Jatropha. In fact, Jatropha could be planted in a damaging way like oil palm. Mr. Garritt suggested that market mechanisms and increased regulation are needed to ensure that companies do the right thing. The second speaker for this panel was Dr. Jeff Obbard of the National University

of Singapore (NUS), who presented on his research on microalgae. Microalgae is receiving much attention nowadays because it is more productive than other biofuel feedstocks, including palm oil, and can be grown in conditions that do not compete with food. Dr. Obbard is particularly interested in connecting microalgae production with Singapore's petrochemical industry where microalgae can benefit from the carbon dioxide (CO_2) generated by power generation facilities, as well as offset carbon emissions from the substitution of fossil fuels.

Panel 4: What are the prospects for certification schemes to reduce negative environmental impacts of oil palm-derived biodiesel?

The first presentation was provided by Dr. Vengeta Rao of the Roundtable on Sustainable Palm Oil (RSPO). Dr. Rao provided a general explanation of the development and structure of the RSPO and the challenges the organization faces in reconciling the industry's activities with environmental protection efforts. The next speaker, Dr. Rosediana Suharto of the Indonesian Palm Oil Council, provided the perspective of the Indonesian producers community on certification schemes. Dr. Suharto stated that they are encumbered by multiple sets of standards, including RSPO criteria and the European Union's (EU) Renewable Energy Source Directive, each of which has different requirements that need to be fulfilled. She also questioned whether it is wrong for Indonesian producers to use their natural resources, as has been done by countries the world over, and why certification should have to be paid for by the producers. She urged non-governmental organizations (NGOs) to put pressure on the producer community to buy certified sustainable palm oil. The final presentation was given by Mr. Bustar Maitar of Greenpeace Indonesia. Mr. Maitar underscored concerns about the RSPO with a series of photos showing RSPO member companies engaged in forest clearance, including on peat. According to Mr. Maitar, the RSPO needs to become a more active and transparent organization and called for the RSPO to back a moratorium against the clearance of forest and peat lands for oil palm.

Panel 5: What additional steps can be taken to minimize the environmental impact of the palm oil and biofuels industry?

Ms. Beth Gingold of the World Resources Institute (WRI) started this session by introducing the Palm Oil, Timber and Carbon Offsets (POTICO) Program. This program, which is being implemented in Indonesia, is trying to promote the swapping of oil palm concessions on forested land for concessions on degraded land, as well as encouraging oil palm companies to sustainably manage forest concessions for carbon credits. Mr. Darius Sarshar of New Forests then presented on the Malua Biobank, a scheme in Sabah, Malaysia, which is trying to monetize the biodiversity value of a former 40,000 hectare logging concession into biodiversity credits, sales of which will go towards the rehabilitation of that concession. Mr. Sarshar explained that this scheme could allow for oil palm companies to show themselves as good environmental stewards by buying biodiversity credits for every ton of oil palm produced. They are also hoping that the RSPO will approve the use of biodiversity credits from Malua as an offset mechanism for oil palm companies that degrade high conservation value forests during an interim period before the RSPO principles and criteria are finalized, which will allow them to maintain their eligibility for certification. This panel ended with an open session wherein the entire audience was encouraged to discuss other innovative solutions.

Opening Remarks

Mr. Javier Mateo-Vega

Director, Environmental Leadership & Training Initiative - ELTI

Yale School of Forestry & Environmental Studies
and
Smithsonian Tropical Research Institute

Mr. Javier Mateo-Vega opened the conference by describing the transformation he has observed in Southeast Asian landscapes since he lived in the region over two decades ago. A significant part of these changes in land use reflect the expansion of oil palm cultivation. The statistics on the current and projected area under production are staggering. Even though oil palm was first introduced in the late 19th century, expansion has been particularly fast since the 1980s. Malaysia's cultivated area has grown from one million to four million hectares, and Indonesia has expanded its production from 600,000 hectares in the mid-1980s to six million hectares in 2007, with future projections of up to 10 million hectares by 2010. This expansion has resulted in an increase in production from approximately five million to 40 million metric tons of palm oil per year. This makes Malaysia and Indonesia the largest producers of oil palm, jointly accounting for 85% of the total global production.

The production of oil palm for biofuels represents only 5% of the total production, with the remaining 95% being used primarily in the food, cosmetics, and pharmaceutical industries. The need to reduce dependence on fossil fuels and reduce GHG emissions, however, promises to further stimulate biofuels production, with Southeast Asia leading the way. The global reaction to the boom in biofuels production has been diverse and wide-ranging, as production touches upon and could affect a wide range of issues including food security, rural employment, social welfare and human rights, energy sustainability, technological innovation and transfer, environmental quality, and climate change. While many of these issues will be touched upon during this conference, the real aim of this event is to explore the production of biofuels through the lens of tropical forests, the environmental services they render, and the well being of the people who depend upon them.

In recent years, vast expanses of forests have been cleared across tropical Asia for oil palm production reducing biodiversity, degrading ecosystem services, increasing the vulnerability of these ecosystems to other impacts such as fires, and affecting local communities and their livelihoods. The clearing of forests for biofuels feedstock production is also raising serious concerns in terms of carbon emissions. When it comes to total carbon emissions generated from all sources, the US and China are clearly the main culprits. But when it comes to the roughly 20% of emissions that are generated from deforestation and forest degradation, Southeast Asia and the Amazon basin come to the fore. According to the 2000 FAO Global Forest Resources Assessment, the total carbon content of forest ecosystems is 638 gigatonnes, a figure that is higher than what is found in the atmosphere. Tropical forests are believed to store 50% more carbon per unit area than forests outside the tropics, with peat forests being particularly important areas for carbon storage. Thus, it is clear that the fate of tropical forests will continue to be an important international issue given concerns regarding climate change and the implications for GHG emissions resulting from the transformation of forests to agricultural landscapes.

Mr. Mateo-Vega concluded by highlighting that the organizers designed the conference to serve as an “honest broker “of information without shying away from the fact that the idea for this event was born from an interest to ensure that the integrity of tropical forests in Southeast Asia, and the livelihoods of those people who depend on these, are not compromised.

How Green are Biofuels? A Tropical Perspective

Dr. William Laurance

Senior Staff Scientist (former), Smithsonian Tropical Research Institute

Distinguished Research Professor,
James Cook University

Dr. William Laurance set the stage for the conference by providing an overview of the implications that increased global interest in biofuels production could have for tropical forests. Biofuels are receiving a great deal of attention, mainly due to the perceived end of the era of cheap oil and the burgeoning demand for energy caused by very high and sustained consumption by industrialized countries, and the rapid industrialization of some developing nations such as India and China. This increased demand, coupled with flat petroleum production, caused significant price increases over the past decade, and as a result, the world is looking for energy alternatives.

It is difficult, however, to find an easy replacement for petroleum, a very energy-dense substance, given that it has spent millions of years "cooking" under high heat and pressure. This is true for the transportation sector as a whole, and the air transport industry in particular, which will undoubtedly remain dependent on liquid fuels for some time. As such, one of the key realities is that biofuels are here to stay and will play an increasingly important role in the global energy economy in years to come.

A second reality is that while biofuels are promoted as "green fuels", the real reason for their adoption seems to be more directly related to national energy agendas and market forces than to environmental concerns. In the US, for example, subsidies for corn production originated from the need to reduce both energy dependence on Middle Eastern countries and the concerns about the large trade deficit resulting from sending dollars abroad to pay for that petroleum. While corn-derived bioethanol currently plays a significant role in the US, the expansion of the biofuel feedstock industry will most likely be centered in the tropics, which has the most favorable growing conditions and an availability of cheap land.

A fundamental question to this conference is whether or not biofuels are indeed a green alternative to petroleum gasoline. One of the main metrics is how they do in terms of GHG emissions, the release of which is causing fundamental changes to the earth's biosphere and atmospheric composition. The answer to this question, however, is not simple and depends on some key factors, including the kind of feedstock crop used and the local growing conditions, the production of bi-products, the changes in land use, and the release of trace gases. The most critical of these factors to consider is whether the production of a certain feedstock contributes to destruction of natural habitats. In particular, we must consider the "carbon payback time" or "carbon debt" associated with biofuel-feedstock production, meaning the number of years it takes for the emissions saved by replacing fossil fuels with biofuels, to offset the carbon emissions generated when the land is converted for growing biofuel feedstock. The payback time is very short if feedstocks are produced on degraded or fallow land, whereas conversion of natural ecosystems (especially dense forests) can delay the payback time to decades and even centuries. As such, a key message of this presentation is that there is no justification for destroying natural forested ecosystems for biofuels.

Complicating this analysis is the fact that we must also address the issue of indirect land-use change that can be driven by biofuels expansion. Plantations of biofuels crops can encourage the displacement of other crops into intact forested areas. For example, the marked increase in American corn production in response to government ethanol subsidies has substantially reduced the production of soy in the US. This in turn has increased global soy prices and resulted in the expansion of soy cultivation in forested areas of Brazil. Similarly, the increased production of sugarcane in Brazil, partly for biofuels, is displacing cattle production into forested areas such as the Amazon. Clearly, if biofuels are promoting habitat loss, whether directly or indirectly, they are not contributing to solving environmental problems and should not be promoted.

Today, the conservation of tropical rainforests is regarded as a key strategy for slowing global warming for a number of key reasons. First, tropical forests store more carbon than just about any other forest type, with much of that carbon being released into the atmosphere when the forests are damaged or destroyed. Second, tropical forests act like cloud-making machines, recycling approximately 50% of rainfall through evapotranspiration, which creates dense low-level cloud cover that in turn reflects heat back out into space. Finally, if one compares forest loss in tropical forests to boreal forests, it is clear that the former can cause greater impacts to climate due to albedo effects. Specifically, if the boreal zone undergoes deforestation, these areas are replaced during parts of the year by snow or ice that reflects the sun's radiation back into space, whereas tropical forests are typically replaced with dark green crops, like soybeans. As a result, the increase in heat generated by GHG emissions is not at all mitigated through an increase in surface reflectivity.

The impact of biofuel crops on the environment, however, is not limited to GHG emissions. Tropical ecosystems are characterized by high levels of rainfall during the wet season and the vegetation is important in stabilizing the soils, reducing stream sedimentation from erosion, and stabilizing the hydrological system so that we do not suffer from flooding in the rainy season and failure of the streams in the dry season. These functions are obviously impacted when forests are converted to biofuel production. Biofuel crops can also deplete water supplies and can reduce the quality of water due to the heavy application of pesticides and herbicides for some biofuel crops. In the American Midwest, for example, the heavy use of fertilizers is causing major eutrophication in the Gulf of Mexico, which is creating ‘dead zones’, where the bloom of algae is depleting oxygen levels and killing fish. The use of herbicides and pesticides also cause trace-gas emissions. Approximately 2-3 percent of nitrogen fertilizer, for example, turns into nitrous oxide, which not only is a very important GHG itself, but also attacks the ozone layer that protects us from ultraviolet radiation. The bottom line is that when we want to talk about the environmental impact of biofuels, we need to take this array of impacts into consideration.

So how do we compare different biofuels to decide which are good and which are bad? In a recent study, Swiss researchers compared 26 different biofuels based on two criteria: 1) their GHG emissions relative to gasoline, and 2) their aggregate environmental impact based on two different indices (the Swiss Environmental Impact Points and European Eco-Indicator). The results showed high variability among biofuels, but the overall conclusion was that many biofuels reduce GHG emissions by approximately 30%. Almost half of them, however, had greater net environmental impacts than gasoline. Biofuels that fared the best tended to be produced from residual products, such as waste from livestock facilities and cooking oil; unfortunately, these have a limited supply.

While most readily available biofuels do not do particularly well under current production processes, there are new potential technologies on the horizon, such as cellulosic biofuels, which show promise. Cellulosic technologies rely on extracting the sugars to produce bioethanol from the abundant residual organic material in plants, especially cellulose. The problem, however, is that the decomposition of cellulose requires a complex biochemical process. Termites and their symbiotic gut biota, for example, use a wide variety of enzymes and over 150 different biochemical steps to accomplish this task, which is presently impossible to replicate at the scale required to fulfill biofuels demands. As such, it will likely take a number of years before second-generation biofuels are commercially available. Nevertheless, we need to move to the point where we are not using food crops as biofuel feedstocks as soon as possible.

One final concern is the fact that global demand for biofuels will likely increase the opportunity costs of conserving tropical forests. The financial returns from timber and biofuels crops are generally higher than the revenue that can be generated from conserving these ecosystems, such as via the sale of carbon credits and other ecosystem services. Hence, carbon trading could end up being competitive only in more remote and unproductive areas – areas that may not necessarily be of the highest ecological concern and certainly not the most imperiled.

In summary, economic and political pressure needs to be applied to combat biofuel production that promotes deforestation, either directly or indirectly. Otherwise, we will inevitably lose more environmentally by using biofuels than we could ever hope to gain.

PANEL 1: To what extent have tropical forests been converted or will be converted to expand oil palm production for biofuels?

Providing the Correct Perspective on Oil Palm Cultivation Effects on Land Use

Dr. Kalyana Sundram

Deputy Chief Executive Officer and Director, Science and Environment Malaysian Palm Oil Council

Dr. Sundram, presenting on behalf the Malaysian Palm Oil Council, provided an industry perspective on the environmental impact of oil palm production. He began by suggesting that oil palm expansion needs to be examined more specifically in the context of the growing world population and burgeoning demands for food. Oils and fats are an essential macronutrient and food has traditionally been the industry's core business. Palm oil represents 31% of the edible oils market and is the largest of all seventeen edible oils commercially available. The usage of oils and fats for biofuels is a more recent trend and currently represents a very small percentage of the market. With the recent boom in demand for biofuels, the challenge ahead will be how to manage palm oil production to supply multiple human demands.

The expansion of oil palm must be looked at in the context of wise land use management since the amount of arable land per capita is declining every year. Oil palm thrives because of its high productivity per hectare and because it has both oil-yielding fruit and seed – characteristics that make this crop ten times more productive than most other crop-based oil source. In other words, an area ten times the size would be needed to produce similar quantities of oil from other crops. While we often hear about expanding areas under oil palm cultivation, comparatively on a global scale, there are more than 120 million hectares of land under soybean cultivation, 32 million hectares under European rapeseed, 25 million hectares under sunflower, and significantly less for oil palm. In fact, oil palm cultivation constitutes less than 5% of the area devoted to oil crops and less than 0.22% of the agricultural land in the world. Hypothetically, if oil palm were to replace soy, canola, rapeseed, and corn production, only 30 million hectares would be needed, relieving approximately 140 million hectares of land for other uses. And it is important to note that current yields of oil palm are below the optimum at only four tons per hectare. Research is underway to boost yields up to eight tons per hectare and beyond, which could reduce land pressures even further.

Global demands for oils and fats are driving feedstock production, and thus increasing land allocations for crops. The US was previously a net exporter of edible oils and fats, but is now almost a net importer, which is driven in part by the demand for biofuels. The EU is also required to import a substantial quantity of edible oils for food production and its mandated supply of biofuels from outside the EU. Currently, the largest exporters of oils and fats are Indonesia, Malaysia, Argentina, and Brazil. If the world adopts biofuels mandates, the land area under cultivation will inevitably expand. And yet the question of which land to be used remains central to the problem. Malaysia, for example, already has 4.3 million hectares under cultivation but may only expand to about 5 million hectares due to the country's commitment to maintain at least 50% under forest cover. Given this type of limitation, it is likely that Brazil and the African continent may undergo an "explosion" of production in the near future. This needs to be managed so that deforestation and carbon emissions do not become a problem.

On the topic of avoided deforestation, it would be best if this increased demand were met by oil palm. If you hypothetically took oil palm out of the equation, the expansion of alternative crops like canola, rapeseed, and/or corn would result in more sizable allocations of land toward the production of crops to meet the burgeoning demand. Thus, there is a large savings in land use if only palm were grown. However, the fact is that it is not possible to grow oil palm all over the world as its growth is primarily restricted to a narrow bioclimatic belt between five degrees north and south of the equator; economic forces and better agricultural techniques, though, are pushing this limit an additional two degrees north and south.

Another issue surrounding oil palm production is indirect land use and the unintended consequences induced by the expansion of lands for oil palm production in response to increased global demand for biofuels. Unless measurements and calculations of the effects of indirect land use caused by oil palm cultivation are more clearly defined and formulated, it will be difficult for the industry to take this concept into account and apply it on the ground. This absence of information will also complicate the use of any type of indirect land use data in sustainability assessments, which already suffer from a number of weaknesses. Life cycle analyses, for example, have proven problematic, as no standardized model exists for conducting them and therefore each study produces different results. Furthermore, many life cycle analysis studies on palm oil use input variables taken from 10 to 20 years ago, meaning that new production practices have not been taken into account.

We must also reassess whether it would be beneficial or not to consider using degraded forests for oil palm cultivation. It has been found that after three cycles of timber harvests, the land is depleted of much of its nutrients and its regeneration capacity has slowed. It is esti-

mated that there are several million hectares of degraded land available primarily in Indonesia, but the potential productivity of this land depends on whether its use is profitable without timber to harvest first and whether costly inputs of agrochemicals are necessary. Most NGOs would rather not allow conversion of degraded forests to oil palm plantations since degraded forests can actually provide good habitat for biodiversity, including the orangutan. It was previously believed that the orangutan population would disappear within 10 years, but a recent aerial survey conducted by an NGO shows that the population in Sabah is thriving. That said, progressive steps must be taken to maintain this population.

To conclude, Dr. Sundram emphasized that fossil fuels are the largest driver of GHG emissions and that the transport sector is primarily responsible. Unfortunately though, people are not willing to give up their cars, air travel, and other practices that spew CO2 into the atmosphere. One solution to manage the GHG emissions generated by the transportation sector is to substitute gasoline with biofuels. The Malaysian Palm Oil Council conducted theoretical calculations using a Volkswagen Golf and concluded that, based on biofuel yield per hectare basis, the car could run 8,000 kilometers on soy, 23,000 kilometers on rapeseed, 33,000 kilometers on bio-ethanol, and 110,000 kilometers on oil palm-based biofuels due to its higher level of productivity. If methane, a potent GHG, is collected from the effluence ponds and used as a biogas, this would add another 99,000 kilometers to the Volkswagen. It should be noted that the industry and Malaysian Palm Oil Board is collaborating with research institutions including the Massachusetts Institute of Technology and others to push the yields towards eight tons of palm oil per hectare in the first instance, and then even higher towards the oil palm's biological optimum, which would be an exciting development.

Impacts of Biofuels on Southeast Asian Biodiversity Hotspots

Dr. Koh Lian Pin

Postdoctoral Fellow
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The expansion of oil palm has been a major driver of land use change, which has raised concerns amongst conservationists due to negative impacts on forests and biodiversity. Oil palm production, however, also contributes to the livelihoods of rural populations and is viewed by many as an engine for rural development, as companies often provide housing, medical facilities, schools, electricity, and drinking water for communities that work on the plantations. The main objective of Dr. Koh's presentation was to present the results of research he conducted on the impacts of oil palm production on forests and biodiversity and to present a series of recommendations aimed at reconciling this activity with conservation and human well-being. He explored two main questions: 1) is oil palm really destroying forests and biodiversity?, and 2) can oil palm plantations be established and managed to make them more hospitable for forest-dwelling species?

To answer the first of these questions, Dr. Koh researched which types of lands have been converted to oil palm to elucidate the relative contribution of cropland versus previously forested land to oil palm expansion. The oil palm industry claims that much oil palm expansion has occurred on areas that were used for cacao, rubber, and coconut production in the past, while many environmental organizations have accused the industry of destroying large tracts of forest. Dr. Koh found that between 1990 and 2005, the area under oil palm cultivation in Malaysia expanded by 1.9 million hectares. During the same period, 15 out of 38 other commercial crops declined in area, by just over 800,000 hectares. Using a simple comparison of oil palm expansion relative to reductions in areas dedicated to other crops, it is clear that the conversion of cropland accounted for at most 45% of oil palm expansion. Since most of Malaysia's land surface area is forest or cropland, he estimated that the remaining 55% of oil palm expansion occurred at the expense of forests. The data also shows that between 1990 and 2005, Malaysia lost 1.1 million hectares of forest. If we assume that this forest cover was lost to oil palm plantations, we can estimate that a maximum of 60% of expansion occurred on forests.

Other studies have since corroborated these findings. The same analysis was conducted for Indonesia and a similar pattern was identified. Dr. Holly Gibbs, who used FAO satellite images from 1980, 1990, and 2000 to create 350 land transition scenes that allowed her to track land cover changes at 117 locations also reached a similar conclusion. Her analysis shows that much of the expansion of cropland occurred from the conversion of intact or disturbed forests, with severe consequences for biodiversity. Hence, more than half of oil palm expansion in these two countries has likely occurred at the expense of forests.

Some oil palm producers have argued, so what if we are losing forest to oil palm since most of the forests are degraded anyway. This leads to the question of the relative impacts on biodiversity of converting different land uses to oil palm. Dr. Koh used his research data on birds and butterflies to show that the conversion of primary and secondary forest results in higher biodiversity loss than conversion of croplands, such as rubber. Other more recent studies have yielded similar results for other taxonomic groups including plants, invertebrates, and vertebrates.

Dr. Koh's second question explored whether plantations can be designed and managed to sustain and enhance biodiversity. While all plantations might appear identical to the casual observer, they actually vary in a number of ways, including the prevalence of epiphytes, ground cover characteristics, the variety of land uses employed within the plantation, and other factors that are visible when the landscape in which the plantation has been established is assessed as a whole. Sometimes, for example, there are variations in remaining forest cover, including pockets of forest that have not been converted for some reason. Dr. Koh examined this variability to see whether vegetation cover on the local scale or forest cover on the landscape scale had a bigger effect on biodiversity in the oil palm habitat.

To conduct his research, Dr. Koh collaborated with a major oil palm company in Malaysian Borneo, which owns three complexes divided into 15 estates on 40,000 hectares. He sampled all fifteen estates and collected 150 independent survey samples of butterflies and birds. On the local scale, the best predictor of species richness of forest-dwelling butterflies was the percentage of ground cover of weeds. This factor had a positive, but relatively minor effect on the number of species. For forest birds, the best predictor of species richness at a local scale was the presence or absence of epiphytes and legumes on the ground, with more birds being found on those estates with significant weed cover. At a landscape level, the best predictor for butterfly richness was the percentage of old growth forest surrounding the estate. For birds, it was the percentage of secondary forest surrounding the estate that had a positive effect on the number of bird species. These results indicate that it is possible to make oil palm plantations more hospitable for biodiversity, but the magnitude of biodiversity enhancement that may be achieved is still nowhere near the level of biodiversity found in primary or secondary forests.

Based on his research, Dr. Koh made the following policy recommendations:

1. Protect both old-growth and secondary forest from conversion to oil palm.
2. Restrict conversion to non-forested areas such as rubber plantation or anthropogenic grasslands.
3. Find creative ways to incentivize the protection of forests and the better management of oil palm plantations. Potential schemes include REDD, biodiversity banking, and carbon offsets.

In closing, Dr. Koh stated that there is sufficient evidence that biofuels, including those produced with palm oil derivatives, are not a panacea for our energy or climate change crisis. They can generate severe environmental and social impacts, not the least of which is potentially compromising food supplies and prices. He further warned that as we now focus our attention on so-called second and third generation biofuels, we need to be careful to assess the true and full range of costs and potential impacts of these processes and products before proceeding.

Identification of Responsible Cultivation Areas for Biofuel Crops

Mr. Fitrian Ardiansyah

Program Director,
Climate and Energy
World Wildlife Fund -
Indonesia Programme

Mr. Ardiansyah began by explaining that even though biofuel production is an attractive option for economic development, it can also generate significant negative environmental and social impacts, mainly in the forms of deforestation and land conflicts. Thus, the ongoing challenge is to find ways to cultivate feedstock crops for biofuels – this is mainly oil palm in the case of Indonesia – without sacrificing remaining forests and ecosystems. In attempts to achieve this balance, WWF, Ecofys, and several companies have been working together to develop a methodology for identifying Responsible Cultivation Areas (RCA), focusing on the province of West Kalimantan on the island of Borneo.

As background, Mr. Ardiansyah explained that one of the primary driving forces behind the development of biofuels was the EU's biofuels directive, which aims to promote the substitution of up to 10% of conventional transport fuels by biofuels. Calculations indicate that this directive could require that 8-31 million hectares of land worldwide be devoted to the cultivation of biofuel feedstocks. This increased international demand is coupled with increasing domestic demand as well. In particular, there are several Indonesian governmental mandates promoting the greater usage of biofuels. A Presidential decree in 2006 calls for transport fuels to contain 5% biofuels by 2016 to 2025. The Ministry of Energy and Mineral Resources calculated that this would require an additional 22.26 million kiloliters of biofuels and may translate to approximately 5 million additional hectares required for biofuels feedstock production in Indonesia. This expansion represents both a direct threat to the forests, as well as an indirect one since the establishment of plantations can have severe displacement effects, i.e. small farmers could lose control of their land to large-scale plantation developers and be forced into forested areas to find new land.

To begin addressing this increased demand, WWF and its partners have been developing a process for identifying and designating RCAs. The goal is to define and delineate areas that should be left untouched, as well as identify areas where abandoned or idle land is still available for cultivation. There are in fact significant amounts of possible idle, waste or abandoned lands in Indonesia as a result of historical destructive land use practices. Some oil palm companies have been known to clear-cut forest on lands that they plan to plant five or ten years in the future, some of which never gets planted. Current estimates of degraded land range from 7-17 million hectares, depending on the source and definition.

According to this RCA methodology, an area is deemed suitable for "responsible" cultivation if it does not cause unwanted displacement effects and complies with the legal and sustainability criteria for site selection of the RSB, RSPO, Renewable Transport Fuel Obligation, and the EU Renewable Energy Source Directive. Taking these certification systems into account, land designated as RCA shares the following principles:

- does not lead to the loss of High Conservation Value areas
- does not lead to a large reduction in carbon stocks
- does not violate formal or customary land rights,
- does not violate national or international law, and
- does not cause unwanted displacement effects.

Implicitly included in these principles are the caveats that food security should be maintained and that a process of stakeholder consultation will take place. Both of these are crucial for effective social development under these new schemes.

The identification and delineation of RCAs is not simple because of the myriad definitions of what constitutes marginal or idle land and the legal implications of selecting a site that may be later subject to questioning. Even the Indonesian government has four categories of abandoned land that could be feasible for palm oil cultivation, namely "lahan terlantar" (unused land) "tanah terlantar"(unused land in legal terms), "lahan kritis" (degraded land) and "lahan tidur" (idle land). All of these land types could in principle be RCA, but other criteria need to be fulfilled in terms of suitability, availability/displacement, and agricultural sustainability.

In general, determining RCAs involves a four-step process. The first step consists of a site pre-selection, through which potentially promising areas are identified on the basis of agricultural suitability and forest and vegetation cover maps, as well as the location of active and inactive concessions. The second step is a desk-based site assessment through which the suitability is evaluated based on existing data and additional data needs are defined. The third step comprises an on-site assessment, through which earlier findings are ground-truthed and the knowledge gaps are filled. This is an important stage, for example, in consulting with local communities. The fourth stage is an evaluation to determine whether the site qualifies as an RCA. Mr. Ardiansyah walked the audience through this process through which they are trying to identify RCAs for oil palm cultivation in West Kalimantan province and several possible target areas within the province.

Mr. Ardiansyah concluded by suggesting that RCA assessments could be developed further, replicated, and adopted by companies, land use planning agencies, and other stakeholders. WWF will continue to improve upon the current system and design approaches for the development of sustainable biofuels that avoid sacrificing forests and ecosystems.

Oil Palm Plantations in Sarawak: Impacts to the Indigenous Dayak Communities

Mr. Mark Bujang

Executive Director,
Borneo Resources
Institute of Malaysia

Mr. Mark Bujang provided an indigenous perspective on the rapid expansion of oil palm plantations in Sarawak, the largest state in Malaysia. The Dayak of Sarawak—an umbrella term for a large number of different indigenous ethnic groups—comprise over one million people out of a total population of 2.3 million. Most Dayak are rural based and still engage in subsistence agriculture, while a small minority maintain a nomadic lifestyle. One of the most contentious political issues in Sarawak is the status of native customary land rights. According to government estimates, there are approximately 1.5 million hectares of Native Customary Rights lands, but this figure is highly disputed because it is based on aerial photographs of cultivated areas and failed to take into account communal forests and primary forest on customary lands. Indigenous groups manage their communal lands, all of which is governed by their own customary law, or adat. These customary laws, however, are regulated by the State Attorney General's office, which is responsible for compiling and codifying these laws.

The rapid expansion of oil palm into Sarawak is only the most recent source of land use conflict. Sarawak was the site of large-scale logging activities from 1960-1990, which led to a high-profile international anti-logging campaign in the late 1980s and early 1990s. Now that most of the higher-value timber has been extracted, many companies are shifting to oil palm production, and much of this expansion is being driven by the demand for biofuels. The government plans to expand oil palm cultivation from 680,000 to 1.3 million hectares by 2010. Private companies will primarily carry out this expansion, though it will also include state government agencies and the Native Customary Rights Joint Venture Schemes, which are private sector programs incorporating smallholders, and some independent smallholders.

In 2004, approximately 48,000 hectares of peat forest were converted to plantations in Sarawak despite objections by the Malaysian Prime Minister. The Sarawak State government, which has significant decision-making autonomy from the central government and maintains its own laws, plans to continue to expand oil palm cultivation into peat swamp forests. About one quarter of the Sarawak landmass, constituting approximately 2.8 million hectares, has been allocated for oil palm plantations under the State's planted forest policy. Approximately half of Sarawak's land mass (six million hectares) has already been logged. Currently, the most rapidly expanding regions for logging and oil palm cultivation are peat swamps. The government is now also focusing on indigenous fallow land, because it is viewed as unproductive. But this fallow land plays an important role in indigenous agricultural systems, improving the low productivity of the soil after cultivation by allowing it to "rest" for 5-10 years between active cultivation periods. In addition, the government claims that converting these rural lands to oil palm provides rural employment, but in fact most of these jobs are taken by Indonesian labor.

As a result of the State's land-use policies, there are currently over 200 cases filed in court regarding conflicts with Dayaks over Native Customary Rights land of which more than half involve oil palm plantations. There are also scores of cases regarding human rights abuses from communities suing the police and government for wrongful arrests when people have taken action to defend their customary lands and practices. The State government has overstepped its bounds by offering provisional leases to oil palm and other companies on native customary forested lands, while it should only be granted on state lands. More specifically, these conflicts arise because the State government only recognizes native customary land in cultivated areas, not communal forests or primary forest within the customary boundaries of lands managed by native peoples. Development of oil palm on customary lands, however, is a violation of the principle of Free,

Prior & Informed Consent (FPIC). If indigenous groups refuse to put these lands under cultivation, they are deemed anti-government and excluded from receiving government benefits. As a result, indigenous groups are often coerced into engaging in these activities. Many locals, however, refuse to work on oil palm plantations because wages are low and better salaries can be secured in cities, such as in the construction sector. Nonetheless, jobs on oil palm plantations are taken up by illegal immigrant laborers from Indonesia who are paid lower wages and are not provided with benefits.

The environmental impacts resulting from the expansion of oil palm have been significant. The expansion has caused an increase in the occurrence of floods, intensified the siltation of the rivers, and resulted in a general decline in fish and wild game, all of which are of concern to indigenous communities. Because of its autonomous status, the Sarawak government does not subscribe to the federal Environmental Quality Act; instead, has its own Natural Resource and Environment Ordinance which is much more lax. Thus, even though the federal government forbids open burning of forests to clear land for oil palm cultivation, for example, this type of activity is still allowed in Sarawak as long as the State grants a permit.

In conclusion, Mr. Bujang stated that the indigenous peoples want their land rights to be protected and respected through official records, delineation, and demarcation. They want to stop the issuance of leases on Native Customary Rights land, which leads to oil palm expansion and illegal logging on their customary lands, including forested lands. Fortunately, the highest federal court in Malaysia recently decided that Native Customary Rights would indeed cover these areas. Finally, the indigenous peoples of Sarawak want to be paid adequate and just compensation for land already taken, and for the principle of FPIC to be upheld. The reconciliation of social sustainability with the expansion of oil palm will be challenging, but must be achieved to progress toward a real model of oil palm sustainability.

PANEL 2: What factors determine the extent to which greenhouse gas (GHG) emissions are reduced by using oil palm-derived biodiesel? Are they better reduced through REDD?

Palm-Oil Derived Biofuels: Are They Good for the Climate?

Dr. Daniel Murdiyarso

Senior Scientist,
Center for International
Forestry Research

Dr. Murdiyarso opened the second panel of the conference by posing the question of whether palm-oil derived biofuels were good for the climate. He then asked whether REDD was a viable land use alternative to oil palm cultivation, which could effectively mitigate climate change and lead to a more sustainable form of economic development.

As background information, Dr. Murdiyarso explained that Indonesia and Brazil are the primary REDD players because they alone contribute, through deforestation and forest degradation, about 20% of GHG emissions, a sum more than that of emissions from the entire global transportation sector. Indonesia has a deforestation rate of about 2% which equates to about 2 million hectares of forest loss each year. Of particular concern is the fact that much of the conversion of forests for oil palm development is taking place on peat lands, which contain much higher levels of carbon than mineral soils. Peat conversion requires the drainage of the peat soils. The top surface of the dried peat is oxidized and compacted, ultimately resulting in subsidence and CO2 emissions. As the land surface declines, the land developer must widen the drainage canal, causing additional emissions. To date, over 600 kilometers of primary drainage canals have been created in Kalimantan alone, many of these were developed during Suharto's era for the Mega-Rice Project. Compounding this problem is the common use of fire for peat land conversion, releasing of additional types of GHGs, including nitrous oxide.

In order to examine the climatic impact of using oil palm for biofuels, Dr. Murdiyarso and his colleagues in a recent paper calculated emissions caused by the removal of biomass for oil palm planting, and the avoidance of emissions created by the substitutions of biofuels for fossil fuels. The objective was to calculate the compensation period –i.e. the period needed to compensate the carbon lost through land use change by carbon emissions saved through the use of biofuels. The researchers arrived at a figure of 75 years for oil palm planted on mineral soils where forests had been converted, 110 years for oil palm on converted mineral soils but involving fire, and 600 years for oil palm planted on peat lands. Developing oil palm on grasslands, which contain relatively minimal biomass, on the other hand, requires only 10 years. In short, the current practice of converting peat lands for oil palm production is very alarming from a climate change perspective, especially given that the World Bank estimates that another 17 million hectares are being planned for conversion.

Dr. Murdiyarso then presented a list of the key challenges associated with the sustainable development of biofuels, including those associated with political economy of oil palm. Among the most important is the competition between oil palm for biofuels production versus food. Two years ago, the price of crude palm oil (CPO) increased in parallel with the price of gasoline, perhaps due to the increasing demand for biofuels in Europe, leading to increased prices and supply shortages of cooking oil in Indonesia. Other concerns surround the possibility of oil palm expanding onto crop lands. Another question is how do we value the forest in terms of ecosystem services, biodiversity, and watershed protection in order to compete with oil palm production? While the idea of developing oil palm on degraded or idle lands, which Indonesia has 20 million hectares of, is a good one, Dr. Murdiyarso was skeptical that much would happen on this front until a strong policy incentivizing this practice is put in place. Lastly, the role of certification is an important one, but it is still unclear how schemes like RSPO will address climate change issues.

As an alternative to expanding oil palm production, Dr. Murdiyarso discussed REDD, a mechanism for compensating developing countries for conserving their forests. REDD has been gaining support at the international level, particularly in the Bali Action Plan, which was agreed upon in December 2007 at the United Nation Framework Convention on Climate Change (UNFCCC) conference. Since then, the UNFCCC ad-hoc working group and others have reached a consensus that the concept of REDD should be expanded to REDD+ with the inclusion of conservation, sustainable management of forests, and the enhancement of carbon stocks. In other words, REDD+ permits a whole array of options for managing forest carbon stocks regardless of where a country sits on the forest transition curve. There is also the potential for monetization of other ecosystem services, including biodiversity and watershed management.

The financial scheme for REDD+, however, is not yet clear. It could be voluntary, market-based, or implemented through a combination of both of these mechanisms. The size of the market is also not certain. The influential Stern Report, for example, indicated that the opportunity cost of forest protection in the eight countries responsible for 70% of emissions from land use could initially be around USD 5 per ton of CO2. The ultimate price, however, will depend on the amount of carbon being offered on the market. Conducting a “back

of the envelope calculation", Dr. Murdiyarso suggested that if Indonesia's yearly CO2 emissions of 3 billion tons could be reduced and compensated at USD 5 per ton, this would yield USD 3 billion per year. By comparison, development aid to the forestry sector in Indonesia over the last two decades has been a total of USD 1 billion. This is also about the same as the loss to the Indonesian economy from "undocumented" timber extraction each year. In other words, there is a lot that could be gained if REDD+ comes to fruition.

Dr. Murdiyarso then provided several reasons why REDD might prove successful. First, the volume of financing could be sufficient to alter the current political economic drivers of deforestation and forest degradation, including the potential conversion of forest for oil palm. Second, REDD has attracted much international, political attention and engagement at the national level, even though the money is not available yet. Third, there is an alignment of the interests of multiple constituencies. Finally, in terms of maintaining credibility of the system, REDD+ is a performance-based finance system wherein payments are made only after the emissions reductions are verified.

In the meantime, funds have been allocated for the preparation and readiness phases of REDD+, but its full implementation will rest on performance-based standards that will need to be monitored, reported, and verified. The World Bank's Forest Carbon Partnership Facility is one of the key players involved in enhancing the capacity of countries for this endeavor. There are currently thirty-seven countries, including eight in Asia, attempting to prepare for REDD+, and there are USD 200 million to help draft policies at the national and sub-national levels. These thirty-seven countries are at different stages in the forest transition curve. So the question remains, how can REDD+ be equitable between these different countries? Dr Murdiyarso hopes that REDD+ can be a win-win situation by improving local livelihoods, improving biodiversity conservation, and improving forest governance.

Dr. Murdiyarso concluded his presentation by emphasizing that all countries should have the same opportunity to engage in REDD+. However, REDD+ poses the risk of promoting human rights violations and corruption if it is not carefully monitored. Impacts associated with REDD+ projects on indigenous peoples must be considered, as these projects should generate positive effects for the social and economic well-being of communities and ensure that costs and benefits are equitably shared among community members. Indigenous people should also be allowed full participation in discussions regarding forest management, as well as in the implementation and benefits of REDD+.

REDD in the Red:
Palm Oil could undermine REDD payment schemes

Dr. Koh Lian Pin

Postdoctoral Fellow,
Swiss Federal Institute of
Technology Zurich

Dr. Koh presented the results of a recent paper which compared the relative benefits of oil palm cultivation to REDD implementation from the perspective of a land use decision maker. The underlying objective was to explore whether REDD can divert future expansion of oil palm plantations away from forests to non-forested areas as it is intended. Using a model to calculate these two scenarios, Dr. Koh concluded that REDD would not be able to compete with oil palm unless REDD is included as a component of the regulatory carbon market.

REDD is currently being developed as a financial mechanism to compensate land owners for the opportunity cost of conserving the carbon stored in forests that would otherwise be lost through deforestation and forest degradation resulting from the conversion to oil palm or other profitable activities. By putting a price on the carbon storage and sequestration service of the forest, REDD is meant to reduce the 20-25% of global emissions originating from tropical deforestation. It is also intended to help conserve biodiversity and assist with poverty alleviation. As things currently stand though, REDD credits can only be traded on the voluntary market or be paid for through special carbon finance funds. If however, REDD is adopted by the United Nations as a legitimate emissions reduction activity, then industrialized nations would be able to purchase these credits from developing countries to offset some of their emissions and meet their reduction targets.

In order to calculate the relative profits of converting a rainforest to oil palm versus preserving it in a REDD project, Dr. Koh and his colleagues first developed an oil palm conversion scenario, basing their analysis on a hypothetical 10,000 hectares of old growth forest in Sumatra, Indonesia and modeled profitability over a 30-year timeframe. They worked with several assumptions: (1) a productive lifespan of 25 years, (2) a 1250-hectare conversion rate per year, meaning that it would take 8 years to convert the entire 10,000 hectares, (3) set up costs of USD 3,816 per hectare, (4) a one-time logging income of USD 1099 per hectare, (5) operations cost of about USD 281 per ton of CPO produced, (6) lifetime yield of fresh fruit bunches ranging from 17 tons per hectare in a low-yield scenario to 20.5 tons in a high yield scenario, and (7) a CPO extraction rate of 21%. Using a standardized yield curve, which took into account the staggered conversion of the fields, they calculated the annual production of CPO over the 30-year period. They then created two pricing scenarios for palm oil based on World Bank figures. Under a constant price scenario, they estimated that oil palm would be worth USD 750 per ton, which was the average price for 2006-2008. A variable price scenario followed World Bank forecasts, with estimates resting well within range of average and peak scenarios for the last 20 years. They then calculated the net present value of accumulated net operating profit, which ranged from USD 38-96 million over 30 years for the entire 10,000 hectare oil palm concession.

For the scenario involving REDD, Dr. Koh modeled REDD profitability under the assumption that the entire 10,000 hectare forest would be preserved, that credits would be sold over the 30 year period, and that avoided deforestation would otherwise occur at a rate of 3.3% per year. No other payment for ecosystem services schemes or economic activities were considered, which could play a role in a real world REDD project. The estimates of carbon biomass (225 tons carbon per hectare), project setup costs (USD 25 per hectare), and annual maintenance costs (USD 10 per hectare) for the REDD project were based on recent published studies. With these figures they created five different scenarios for carbon pricing, two of which were based on futures contract prices traded on the voluntary market and the remaining three on carbon prices traded in Kyoto Protocol compliance markets. The conclusion is that restricting REDD credits to voluntary markets limits profits to USD 6-10 million over thirty years, which is substantially lower than the oil palm profitability scenarios. However, if credits could be traded under a compliance market system, such as under the Clean Development Mechanism, profits would be boosted to USD 16 - 66 million, which would give REDD a fighting chance against oil palm expansion. This analysis indicates that that unless REDD credits are allowed to be traded in Kyoto compliance markets, it will not be economically competitive with palm oil and therefore will not effectively avoid deforestation and forest degradation.

Despite its potential, REDD has not been adopted as part of the Kyoto mechanism because it still faces political, technical, and ethical challenges. First, there are concerns about the ethics of allowing rich nations and corporations to absolve themselves of their “carbon sins” by offsetting their emissions through a REDD scheme. Second, there are challenges in establishing deforestation baselines, which estimate carbon emissions in the absence of a REDD project. Third, there is the need for a monitoring system to account for “leakage” or the displacement of deforestation from the REDD project area to a non-project area. Fourth, there is the problem of permanence, or the problem of guaranteeing that protected carbon stock will not be lost before or after the project period, whether it be through human or natural occurrences like drought and fires. Fifth, there is the issue of national sovereignty and native land rights. Sixth, REDD schemes need to ensure that all benefits are distributed in an equitable manner and reach the people on the ground who may have given up their native land rights. This will especially be a challenge if REDD is developed at the national level. Finally, some environmental groups are concerned that opening the markets to REDD credits could drive the price down for carbon credits and crash the market.

Nevertheless, Dr. Koh remained cautiously optimistic about REDD, suggesting that it should be part of the portfolio of solutions to mitigate climate change because it is a way for richer nations to share in the financial burden and opportunity cost of conserving forests and biodiversity in poorer nations. With large companies nowadays being the major drivers of deforestation, yet showing a willingness to conserve some forests on their estates and always being on the look out for the next profitable crop, Dr. Koh wondered whether REDD could shift oil palm companies from being adversaries to partners in conserving forest ecosystems.

The Roundtable on Sustainable Biofuels: Ensuring that Biofuels Deliver on their Promise of Sustainability

Mr. Ibrahim H. Rehman

Director,
Social Transformation
Division - The Energy and
Resources Institute

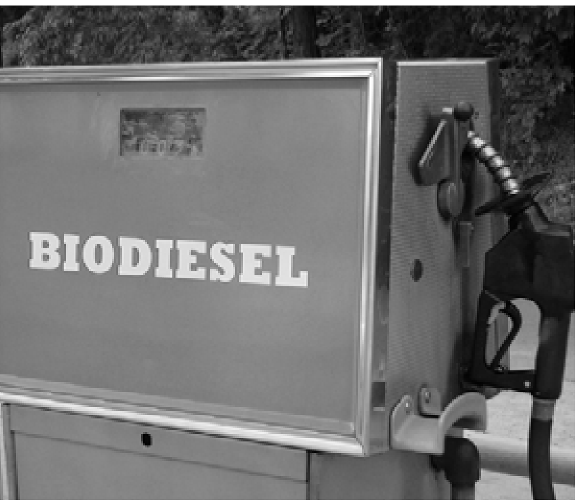
Mr. Rehman provided an introduction to the RSB, an international multi-stakeholder initiative aimed at developing a sustainability certification program for biofuels production. The RSB is unique given its global scope, while other biofuels standards such, as the EU sustainability standards and the California Low Carbon Fuel Standards, are regional in nature. Moreover, while there are other existing initiatives and standards focused on biofuel feedstocks, like the RSPO, the Roundtable on Responsible Soya (RRS), the RSB is unique in that it is developing a comprehensive set of principles, criteria, and indicators that can guide the entire certification process for all biofuels and biofuel feedstocks.

The RSB was initiated a couple years ago and at the time of this conference, had developed a first trial version of the Principles and Criteria, called Version 0. The principles and criteria underlying the standard are intended to be generic, focused on environmental and social issues relevant to the entire biofuels production process, and must adhere to national laws and international treaties. RSB has been developed through a comprehensive, consultative process involving all stakeholders and incorporates concerns over labor rights, social and economic development of communities where the production processes occurs, food security, and biodiversity.

The entire process has been instituted at the Federal Institute of Technology in Lausanne, Switzerland, which serves as the Secretariat for RSB. Until the end of 2008, the RSB had a number of working groups focusing on one particular thematic area (e.g., GHG emissions), and a founding steering organization comprised of government, corporate, international research organizations, and NGOs. Membership to the working groups was open, with both virtual and in person meetings. From June 2009, the governance process will change, and a Standards Board and experts group will create 11 chambers representing different constituents (i.e. industrial producers, retailers, blenders, civil society organizations, rural development and food security organizations, trade groups, etc.), with at least one representative from the North and one from the South. The Standards Board will have one representative from each of the 11 chambers. The RSB has been multi-stakeholder in nature, relying on working group teleconferences, over 15-in-person stakeholder meetings throughout the world to discuss Version 0, involving over 900 participants, with all meeting reports and comments being hosted on the website.

Mr. Rehman provided several examples of the types of feedback that they received on principles pertaining to food security, conservation, and land rights. Of most relevance to this panel was Principle 3, which states that “Biofuels shall contribute to climate change mitigation by significantly reducing GHG emissions as compared to fossil fuels.” Stakeholder feedback focused on a number of factors. First, one issue intensely debated surrounded the difficulties of trying to compare different life cycle analyses, and the fact that too much subjectivity could creep into the process. A recommendation was that life cycle analyses of GHGs conducted on different products (biofuels and fossil fuels) must use the same methodology. Second, participants stated that it is important to quantify what is meant by “significantly” in the phrase “significantly reducing GHG emissions”, or remove the word entirely. Finally, while most people felt that indirect land use impacts are important, some stakeholders felt that there is not sufficient scientific consensus to support the inclusion of indirect land use change in GHG calculations and that it should be de-emphasized until better methodologies for measuring them have been developed. Still, others felt that the sustainability criteria should only include practices under the control of the producer.

Mr. Rehman ended his talk by pointing to changes that were being made to the RSB’s internal governing structure and the future direction of the RSB in further developing the standards. In a world of burgeoning standards, the RSB hopes to minimize the burden to industry by acting as a meta-standard, wherein they recognize other certifications schemes, like the RSPO and RRS, but add on requirements pertaining to GHG emissions and macro-effects which are often excluded in the other standards. By doing this in an open and transparent way, Mr. Rehman suggested that they could avoid the criticism that such standards serve to legitimize and draw attention away from the questionable industry practices.



Low Carbon Intensity Biofuels and Sustainability: Perspectives from the California Energy Commission and the Alternative and Renewable Fuel and Technology Program

Mr. Jim McKinney

Supervisor,
Emerging Fuels and
Technologies Office
California Energy
Commission

Mr. McKinney shared the perspective of California, a major consumer of low carbon intensity fuels, where he is in charge of developing the sustainability certification standards for his program at the CEC. The main theme emphasized in his presentation is that due to US state and federal efforts to increase the carbon intensity of vehicle fuels, there will be a major shift away from petroleum-based fuels in the near future. Biofuels are poised to play a large role in that transition, but questions remain about the environmental impacts associated with the increase in their feedstock production and how biofuels fit into their sustainability programs.

As background, Mr. McKinney explained that California has 36.8 million people and a Gross Domestic Product of USD 1.8 trillion, making it the 8th largest economy in the world. California has GHG emissions of 440 million metric tons, which is 7.2% of total US emissions and which makes it the 10th largest emitter on a global scale. The transportation sector accounts for 38% of all GHG emissions resulting from 26.3 million cars and 92 million trucks that ply California's roads; so there is a real push by state government to drive down GHG levels of vehicle fuels. Annual fuel consumption is roughly 20 billion gallons, making California the third largest consumer of vehicle fuels after the rest of the US and China.

The CEC is the lead information and policy development arm of the State of California. They track issues related to the development of transportation fuels. They administer energy efficiency standards for appliances in the State of California, license thermal power plants, and track information on supply and demand balances. They administer the Renewable Portfolio Standard, which will require 20 percent renewable mix in the electricity production sector by 2012 and 30 % by 2020. They also administer about USD 84 million per year in Public Interest Energy Research funding for advanced energy systems and environmental impacts associated with energy production.

There are a number of major state and federal policy drivers that will increase demand and use of low carbon intensity biofuels to meet GHG reduction goals. At the state level, the first is AB32, the Global Warming Solutions Act, which is supposed to reduce GHG levels by 30% by 2020 and 80% by 2050. The second is the Pavley Bill, which seeks a 30% reduction in vehicle emissions through energy efficiency gains and switching to lower carbon intensity fuels by 2016. The third is the California Low Carbon Fuel Standard, which seeks a 10% reduction in carbon intensity of transportation fuels by 2020. Finally, at the federal level, the Renewable Fuels Standards I and II seek to promote the production and use of renewable fuels. To qualify as a renewable fuel under the Renewable Fuel Standards, a 60% GHG reduction is needed for cellulosic biofuels and 50% GHG reduction for biomass-based diesel and advanced biofuels.

To meet the Renewable Fuel Standard, the CEC is looking at and evaluating a whole range of alternative fuel options, of which palm-based diesel is only one. The CEC has been funding life cycle analyses of these fuels to determine the percentage carbon reduction for each, in support of the California Air Resources Board implementation of the Low Carbon Fuel Standard. Mr. McKinney did not have figures for oil palm, but indicated that the Malaysian Palm Oil Council has recently hired a major contractor doing these studies and should have figures soon. However those numbers turn out, biofuels will have to compete with some very low carbon fuels or alternatives. The Ports of Los Angeles and Long Beach, two of the biggest ports on the West Coast of North America, for example, are not discussing the use of biodiesel at all. They are rather looking into switching to electrification, compressed natural gas or liquefied natural gas. Nevertheless, the potential for biofuels is huge – a 20% biofuel blend would require close to a billion gallons of biodiesel in the coming years. Furthermore, biofuels have the advantage that they fit readily into California's infrastructure, meaning that they can use the same pipelines, tanks, and can be burned in the same types of engines without too many modifications. The flipside are the environmental concerns.

As part of AB118 or the Air Quality Improvement Program, the CEC administers a 1.5 billion dollar funding program over eight years that is meant to kick-start the market to speed up the development of these alternative fuels. The bulk of the money is going to electrification (46 million), hydrogen (40 million), and natural gas (43 million). The biofuels industry was shocked that only 28 million dollars would be spent to promote biofuels. The number is low in part because of the negative messages about the environmental impacts of biofuels, like oil palm, are resonating with political appointees and legislators. In California, the perception of oil palm has been linked to the issue of deforestation and the plight of biodiversity like orangutans. These perceptions overshadow some of the environmental and economic benefits that could be gained from using palm oil biodiesel, but perception equals political reality, which in turn equals real consequences.

The CEC as a whole recognizes that a rapid transition to alternative fuels has the potential to encourage environmentally destructive production practices. Because of these concerns, Mr. McKinney's office has spent the last year developing sustainability standards with which to gauge programs that are applying for this funding. The goal is to identify and promote transportation-related GHG projects that are exemplary in sustainability and environmental performance, as well as support projects that can serve as national and international models. CEC is one of the first government agencies in the US to create these standards, so they have been making these standards up as they go. The initial focus is on bioenergy crops because that is where the damage is taking place primarily.

Mr. McKinney ended his talk by giving some of the lessons that he has learned in generating these standards. One of the tensions that he has experienced is the need to develop very robust standards, but the fact is that there is a danger that no one will grow those crops due to the high cost of meeting those standards. Thus, while sustainability means doing things better than before, the question remains how much better is enough for something to be considered sustainable. This leads to the question of what needs to be measured to know if we are really doing things better. Finally, Mr. McKinney mentioned that some foreign producers have complained about the sustainability requirements being more stringent than the regulatory requirements and have argued that these hurt their national economic development and the poor. Mr. McKinney responded, by saying that as a regulator in California, he does not have the right to tell foreign producers how to produce things, but as a consumer, he has every right to choose what he wants to purchase.

PANEL 3: What is the potential for second-generation biofuel feedstocks, such as Jatropha and algae, to reduce negative environmental impacts associated with oil palm?

Potential for Jatropha to Reduce Negative Environmental Impacts Associated with Oil Palm

Mr. Tobias Garritt

Chief Executive Officer
Eco-Emerald Ltd.

Mr. Tobias Garritt discussed the sustainable production of Jatropha as a biofuel feedstock and for other uses, based on his experience in developing plantations in the Regencies of Jayapura and Biak-Numfor in the Indonesian province of Papua. Papua is a logical place for the development of biofuels because all of the electricity generated in the province is fueled by diesel, a portion of which is flown in by plane, resulting in a very large carbon footprint. The company's goal is to cultivate 40,000 hectares of Jatropha by 2016, distributed amongst individual farmers who will produce approximately 100,000 tons of crude Jatropha oil per year and 200,000 tons of organic fertilizer. The Jatropha oil will be enough for energy production in the Regencies of both project sites, as well as for export to other parts of Indonesia and international markets, particularly for the air transport sector. Eco-Emerald's business model is also based on selling the organic fertilizer, bio-pesticides derived from the Jatropha, and carbon credits earned for carbon sequestration and fossil fuel offsets.

Mr. Garritt's goal is to integrate Jatropha production into existing agricultural production systems, using local cultivation techniques, without competing with food production for land and labor or having negative environmental impacts. To achieve this goal, Jatropha is grown on deforested or marginal land or integrated into existing systems, which are adapted to make them more environmentally friendly. Herbicides and pesticides are minimized through the introduction of bio-pesticides and integrated pest management, while productivity is raised through the introduction of intercropping models. In addition to striving for environmental and social sustainability, this project also needs to achieve technical feasibility with the available resources and profitability for all stakeholders.

Jatropha is an oil seed-bearing bush or tree, which can grow in a variety of different climates. The plant can grow up to 1000 m above sea level and survive with rainfall as low as 900 mm per year. It matures between three and five years of age, depending on environmental conditions. Oil yields range significantly depending on field conditions and the varieties of Jatropha used. Eco-Emerald's experience in Papua, where 2500 mm of rainfall is distributed evenly throughout the year, has shown tree heights ranging from 70 cm to 2 meters within seven months. These trees also produce their first fruits at seven months, at which point a hectare may yield 300-500 kg of seed in the first year. This yield eventually increases up to 4-5 tons of seeds per hectare upon maturity around years 4 and 5. While stories abound about “super Jatropha” plants, Mr. Garritt warned that he has seen very productive varieties of Jatropha taken from one location to another that fail completely.

Mr. Garritt cited the importance of examining the environmental and social impacts associated with oil palm many of which do not occur, or are reduced in Jatropha production. Despite recognizing that many companies are taking steps toward achieving greater sustainability in their practices, oil palm production as a whole continues to be a massive driver of deforestation, permanent land use change, and a destroyer of carbon sinks. Its production causes habitat conversion and biodiversity loss, and the clearing of land through burning results in widespread air pollution. Oil palm plantations have also been shown to be important contributors to soil erosion and to rely heavily on polluting agro-chemicals.

The social impacts of oil palm cultivation, including improper land acquisition and compensation methods, also need to be recognized and addressed. In Papua, traditional land titling is strong, but communities are often approached by companies to sign away land rights, without realizing the scale of a 40,000 hectare plantation and the impact that it will have on the environment. FPIC should always be observed, not only for the benefit of the local communities who can use this tool to oppose the plantation of oil palm, but also for the benefit of the land developer who can then avoid land use conflicts. The influx of migrant laborers can also exacerbate problems, as local communities are often pushed deeper into the forest, causing greater environmental impacts, including human-wildlife conflict.

Unfortunately, growing biofuels in a way that meets sustainability goals can be expensive. Timber revenue from land clearing substantially offsets the establishment cost of oil palm plantations, and land burning for clearing purposes is inexpensive. Mr. Garritt believes that we need regulations and market mechanisms to incentivize companies to make the right decisions and get on the path to sustainability. Jatropha, as a major agricultural crop, needs the same safeguards. But Jatropha, as a second-generation biofuel, is indeed different from first-generation biofuels feedstocks because it does not compete with forested lands, and can be cultivated in areas that are not suitable for agriculture.

Eco-Emerald's Jatropha production strategy addresses the environmental impacts of land use and agro-chemical use. Eco-Emerald emphasizes that land should be used for its most suitable purpose, meaning that Jatropha should not be planted in forests, or its planting result in deforestation. Soil types also need to be taken into consideration. There is plenty of marginal or degraded land in Indonesia, but identifying it, and the political issues surrounding that land, can be complicated. Burning and the use of herbicides should also be minimized and erosion avoided. The company is experimenting with integrated pest management and bio-pesticides to combat stem and fruit pests, which do in fact attack Jatropha, despite the common belief that Jatropha is immune to pests. In terms of social sustainability, education and training of local communities has been critical in the progress of this project and has helped to create a common and clear vision among all involved.

In concluding, Mr. Garritt asserted that every crop has its strengths and weaknesses, but it is the implementation of the system that creates success, and not the plant or crop itself. After all, Jatropha could also be cultivated in an equally unsustainable system and cause similar problems to oil palm. If done right, though, Mr. Garritt suggested that Jatropha can be simultaneously sustainable and profitable, and raised the question of whether oil palm can be profitable without the timber revenues generated from logging during plantation establishment, or technically feasible when environmental and social sustainability are considered. Mr. Garrit does indeed think it possible and concluded by stating that if sustainability systems, such as those employed by Eco-Emerald in Jatropha production, were employed in oil palm plantations, many of its environmental impacts would be reduced or eliminated altogether.

Microalgae Derived Biofuels: The Quest for Renewable and Carbon Neutral Feedstocks

Dr. Jeff Obbard

Associate Professor,
Environmental Science
and Engineering Division
National University
of Singapore

Dr. Jeff Obbard presented an overview of his research on the use of micro-algae as a biofuel feedstock. Microalgae have garnered world-wide attention as a sustainable alternative to terrestrial bioenergy crops because they do not compete with food crops for land and can be found in abundant quantities in both fresh and marine water. Dr. Obbard is working on increasing the oil yield of microalgae and reducing the cost of the production and, based on his research results, believes that microalgae will play an important role in the future of biofuels.

Dr. Obbard presented three "hard truths" that serve as the impetus for his research into biofuel feedstocks. First, according to the International Energy Agency (IEA), fuel consumption is estimated to increase by 50% by the year 2030. As things currently stand, eighty percent of that increased consumption will be met by fossil fuels, which would increase carbon emissions by approximately 60% over the next twenty years. Second, the chief economist of the IEA predicted that "peak oil" will occur in three to four years in countries that are not members of the Organization of Petroleum Exporting Countries (OPEC) and global oil production is expected to peak by around 2020, posing a threat to national and international energy security. Finally, in 2007, the Intergovernmental Panel on Climate Change reported a greater than 90% probability that anthropogenic carbon emissions are driving climate change. That report further indicated that the Earth's temperature is projected to increase by 6.4 degrees by the end of the century and that long-term, irreversible changes, like the melting of the polar icecap, have already started to occur.

One of the proposed solutions to our dependence on fossil fuels and the threat of anthropogenic climate change is biofuels production. In principle, biofuels can be carbon neutral due to photosynthesis, the process through which plants capture CO2 from the atmosphere to create biomass. If that biomass is converted into biofuels, the subsequent combustion of the biofuel releases the same amount of CO2 back into the atmosphere. Biofuels production, however, can have a variety of detrimental environmental impacts, as has become abundantly clear with oil palm, which result in additional GHG emissions. Dr. Obbard asked rhetorically "Can microalgae do it better?"

This is not the first time that microalgae has been investigated as a source of renewable energy. Following the OPEC oil shocks in the 1970s, the US National Renewable Energy Laboratory conducted 15 years of research into microalgae and other biofuel feedstocks. But this project was cut short when oil prices reached USD15 a barrel in the mid-1990s. With increasing oil prices, however, there is renewed interest in microalgae as a biofuels feedstock. The advantages of microalgae as a biofuels feedstock are numerous. First, the oil production from microalgae can be ten to fifteen times higher than achieved with oil palm. Second, microalgae can be grown at sea, where it does not require fresh water resources, or in ponds in wasteland areas (i.e., abandoned shrimp ponds) so that its cultivation does not require areas that are dedicated for food production. Third, microalgae can be used to create biodiesel or bio-ethanol. Fourth, the production process can be linked with waste CO2 emissions sources (i.e., from power generation stations), potentially resulting in carbon negativity. Finally, there are other valuable chemicals or byproducts that algae produce naturally which have pharmaceutical or nutraceutical applications. In some cases, these so-called byproducts may have greater commercial potential than the biofuel feedstock itself.

Dr. Obbard's research group started their work on microalgae in 2006, when oil was about USD 50 per barrel and increasing. In 2007-2008, they sampled the waters surrounding Singapore for microalgae, and isolated approximately fifty strains in the lab. They started off using traditional culture techniques, but eventually graduated to using flow cytometry. The technique works by staining intercellular lipids with a fluorescent dye, which under a laser allows them to measure the fluorescence of lipids and, using gravimetric techniques to equate that to a particular lipid content of individual cells. This technique also allows them to identify individual cells with the highest lipid content within a group of cells from the same population.

Other researches have focused on ways to manipulate the growth rate of the microalgae in a photo-bioreactor by altering chromatic exposure to the cells and gas content of the air. They found that native strains of microalgae have up to 45% oil content, and can be manipulated to produce up to 65% oil content. They also found that microalgae can perform quite well in an environment enriched with CO2, sulfur dioxide, and nitric oxide. By using CO2 to stimulate growth in the algae, they can essentially achieve carbon neutrality or even carbon negativity. Finally, because getting the algae cells out of the water is quite energy intensive, they have also been working on refining new techniques to concentrate the cells and extract the oil in a more energy efficient manner.

Dr. Obbard concluded by emphasizing that Singapore is a very attractive location for microalgae biofuels production due to its strategic location and tropical climate. His short-term goal is to generate enough microalgae biodiesel to run a bus on the NUS' campus, at least as a blend with mineral fuel. In the longer term, he sees good opportunities for interacting with Singapore's large petrochemical sector. The goal here would be to divert CO2 from a power production plant into raceway ponds—i.e., shallow artificial ponds used to grow algae—which would be used to enhance biomass growth for biofuels production. This would be a "double whammy" in terms of mitigating CO2 emission because the CO2 from the power plant would be sequestered into the biomass, and then those carbon neutral/negative biofuels would replace the use of the carbon-intensive fossil fuels.

PANEL 4: What are the prospects for certification schemes to reduce the environmental impact of oil palm cultivation?

The Roundtable on Sustainable Palm Oil

Dr. Vengeta Rao

Secretary General
(former)
Roundtable on Sustainable
Palm Oil

Dr. Vengeta Rao provided a presentation on the RSPO, a voluntary, multi-stakeholder group started in 2003 and registered in 2004 with a mission to provide certified sustainable palm oil to the market in a clear and transparent manner. The RSPO remains officially neutral in discussions regarding markets and the allocation of palm oil for food, oleochemicals or fuel, nevertheless remains an important actor in influencing palm oil producers' behavior and shaping public perceptions about the social and environmental impacts of palm oil production.

Dr. Rao began his presentation with a brief history of palm oil, narrating the changing perception of palm oil in Europe since the 15th century from adulation to condemnation. In reality the importance of palm oil today stems simply from the fact that the palm species is the most efficient producer of a wholesome edible oil – its average production is of 3.68 tons per hectare, compared to 0.59 tons for rapeseed, 0.42 tons for sunflower, and 0.36 tons for soybean. As a result, oil palm is the number one edible oil and has become ubiquitous around the world, appearing on ingredients lists in more than half of packaged food products in supermarkets. Historically, oil palm has always been used for both food and fuel, but Dr. Rao emphasized that the new demand for renewable fuels increases the importance of delivering sustainably produced feedstock.

Institutionally, the highest authority of the RSPO rests with a General Assembly of Members, and its operational authority with the Executive Board. The RSPO currently has 362 members, representing seven categories, including—ordered from largest to smallest—processors/traders, oil palm growers, manufacturers, retailers, environmental NGOS, banks/investors and social NGOs. There are also 93 affiliate members. Indonesia has the largest number of members, followed by Malaysia, Europe (nine countries), Singapore, South America (eight countries), China, India, and Australia. The growth in membership has been rapid, especially since 2006.

The RSPO has established certification standards containing eight principles, 39 criteria, and about 130 indicators; the number of indicators depends on national interpretations. The RSPO Principles & Criteria is a living document subject to review every three years. The indicators, on the other hand, are subject to an annual review. When the Principles & Criteria were developed in 2004-5, it was recognized that the perfect should not be the enemy of the good and that they needed something to start with, but this would need to change over time. Various criteria and indicators are currently under review, including herbicide usage, GHG emissions, and biodiversity. There is also an expert working group exploring how the certification process can be more robust in terms of new plantings. RSPO is also examining the accreditation of various certification bodies, and weighing the advantages and disadvantages of outsourcing this practice.

With the RSPO certification system being the most rigorous agricultural production standards around, there is a need for extensive capacity building to train all stakeholders, including auditors and plantation personnel. These efforts have been met with much success, as governments and companies that had previously been reluctant to join the RSPO in 2004 and 2005 are starting to see the standards as an acceptable way forward. An example is the Memorandum of Understanding signed between the RSPO and the Department of Agriculture in Indonesia in March 2009 for extension training on RSPO principles and criteria to Indonesian growers. Another is the 2009 Malaysian budget, which stated that the government fully supports the initiative by palm oil plantations to obtain RSPO certification and allocated MYR 50 million funding to support the program.

The certification is performed by third party certifying bodies. These are benchmarked against guidelines of the International Organization for Standardization, which also require annual accreditation by national or international accreditation bodies. The actual unit of certification is the mill and its fruit supply base. Because many of the

companies involved are very large (e.g. multi-unit companies), they are given the option to present a timeframe during the first certification audit process laying out when the other units of that company will be certified. This is to provide flexibility in compliance with the standards. If there are associated smallholders, they are likewise given a three-year time frame to become RSPO-compliant.

The audit report produced by a certifying organization goes through a peer review system with 7 members of the RSPO executive board and generally takes 4 to 6 months. This is preceded by the dissemination of an audit announcement and stakeholder letters asking for public comment and input a month beforehand. If the audit report is acceptable, the certifying body issues certificates for the tonnage of oil and kernel of that particular mill. The volumes that are certified are fed into a database of registration and certificates. Apart from the main report, a public summary report is published on the RSPO website which announces the name of the company, the location of the mill, the crop base itself, the stakeholder consultation results, the assessment team members, and the assessment findings. There is an annual surveillance audit following the main audit, but the main certification is valid for five years. If there are major nonconformities, they must be addressed within 60 days, while minor nonconformities are given a year until the next surveillance audit.

The first certification was achieved in August 2008, and Dr. Rao estimated that 1.57 million tons of oil palm and 340 tons of kernels have been certified from companies in Malaysia, Papua New Guinea, and Indonesia since. Many companies are currently undergoing the peer review process, and Dr. Rao estimated that there could be as many as 2 million tons of palm oil certified by June of 2009, and possibly 3 million tons by the end of 2009.

Palm oil is a huge commodity with millions of tons being traded, so separating certified and non-certified palm oil is a real challenge. At the present time, there are 3 supply chain options: 1) segregation, 2) controlled mixing, and 3) book and claim. Under segregation, the supply chain guarantees that the CPO that originates from one or several certified plantations is not mixed with conventional palm oil. Under controlled mixing, the oil traded contains a percentage of certified palm oil and a percentage of conventional oil. In the third option, the company gains certificates for the certified palm oil produced, which can then be sold, while the oil itself gets mixed with conventional oil.

The supply chain options vary in price and the claims that can be made about the oil also depend on the option chosen. In all three cases, the supply chain options require an assessment and proof of the chain of custody in order to ensure the integrity of the system. During the first six months of certification, parties are allowed to practice self-assessment. After that time period, a third party must certify whether they can maintain the segregation and handling of RSPO-certified oil.

Dr. Rao concluded by discussing one of the key challenges that the RSPO is facing, namely bringing smallholders into the scheme. In Malaysia, 11% of hectarage under oil palm are controlled by smallholders and 30% under government schemes, while in Indonesia 39% are under smallholders and 10% under government schemes. The principles and criteria that will apply to smallholders will necessarily be different for smallholders, as will the national interpretations. RSPO is currently working to develop a group certification scheme, focused on the fresh fruit bunches, which will be independent of whoever processes them.

Certification for Sustainable Palm Oil to Reduce Environmental Impacts

Dr. Rosediana Suharto

Executive Director,
Indonesian Palm Oil Commission

Dr. Rosediana Suharto addressed the challenges associated with palm oil certification for producers in Indonesia. The RSPO certification system is the first of its kind created to deal broadly with sustainability issues, but it is not the only set of criteria that palm oil producers have to contend with. The EU Renewable Energy Directive, for example, also applies to palm oil. Dr. Suharto emphasized that the formulation of these certification systems is an ongoing process and pointed out that, while Indonesia is working hard to implement the RSPO criteria, having to address these multiple systems can be expensive and time-consuming.

To make this point, Dr. Suharto elucidated the differences between two of the systems. First, the RSPO, which is a voluntary standard, bases its certification system on the triple "P"s: planet, people, and profit. It has 8 principles, 39 criteria, and 139 indicators for Indonesia. The RSPO criteria cover the whole host of environmental concerns related to the management of the oil palm plantations and mills, including the status of threatened and endangered species, recycling, energy efficiency, GHG emissions, fire management, and new plantings. Alternatively, the EU Criteria for Renewable Energy is a mandatory system mainly intended to reduce emissions vis-a-vis fossil fuels, with an increasing reduction target over time. The EU Criteria for Renewable Energy also considers the environment, and attempts to limit the use of lands with high carbon stocks and biodiversity value, including primary forests and other wooded areas, protected forests, natural grasslands, and wetlands.

Certification systems are based on an audit, a systematic, independent process for obtaining evidence and evaluating the operations objectively to determine the extent to which the audit criteria are being fulfilled. These audit criteria include applicable policies, procedures, standards, laws and regulations, management system requirements, contractual requirements and industry/business codes of conduct. The existence of so many criteria and the need for full documentation, make the audit costly and very time consuming for the producers. Another problem is that some things remain outside of a company's control. If the government, for example, gives the company a piece of land that is then left uncultivated for five years, the government will place the company on a black list. As a result, there are some RSPO member companies that are currently working to fulfill these criteria, but many others are not. Of the 1500 oil palm companies, 48 are members, while the others are not, although some of the non-members are also taking steps to make their systems more sustainable.

In terms of the potential for certification systems to limit deforestation in Indonesia, Dr. Suharto indicated that Indonesia currently has about 133.5 million hectares of land, of which 64% has been designated forested land. Of that forested area, about 20% consists of protected areas and 5% consists of oil palm (which meets the official definition of forest), while additional oil palm occurs outside of the official forest estate. The oil palm industry started large-scale development in Indonesia in 1992, taking advantage of 50 million hectares of land that had been logged since the 1970s under President Suharto. Many plantations, however, have maintained portions of that degraded forest in the middle of their estates. Meanwhile, the development of oil palm plantations on peat, which has been gaining much international attention, has only occurred on 2.5% of the 20.94 million hectares of peat in Indonesia. Dr. Suharto also mentioned that recent research has found that the amount of primary forest that was cleared for oil palm has been much less than was previously believed and that oil palm plantations have more carbon than forests that have been repeatedly logged.

Dr. Suharto asked why is there so much opposition to oil palm, which only accounts for 7.1 million hectares in Indonesia. Numerous other countries also contain large areas of monocultures, including the US, which has 43 million hectares under soybean and corn, and Brazil, which has 27 million hectares under soy bean. Deforestation in Indonesia has occurred for a number of reasons, including logging, infrastructure development, mining, and pulp and paper. The fact of the matter is that Indonesia is simply using its God-given assets, similar in the way that Australia has utilized its mining reserves, Russia its natural gas, and Thailand its agricultural potential. Additionally, the trend of increasing resource consumption in Indonesia can be partially explained by the population explosion from 120 million in 1950 to 220 million people currently.

Dr. Suharto said that many palm oil companies would like to be certified but questioned why the burden of sustainability and certification requirements must fall entirely on the producers of palm oil and not on the buyers. This point was made more egregious by the fact that the demand for sustainable palm oil does not currently exist – even

Unilever, one of the leaders of the RSPO, has only agreed to buy 500 tons of certified palm oil out of millions. Moreover, the RSPO does not even have an office in Europe to promote RSPO certified palm oil, which seems necessary given that the EU Directive is also making high demands, requiring fully segregated palm oil. In short, if there is no demand and no guarantee of a premium price for certified palm oil, there will be no production. Dr. Suharto called for NGOs to begin rallying the consumers, not only the producers. Finally she expressed concern that only the largest plantation will be able to participate and smallholders will be sidelined by a system that is too complicated.

Dr. Suharto concluded that the two sets of sustainability criteria espoused by the RSPO and EU, may force oil palm producers to possess two certifications, which could prove cumbersome and costly. This would prevent smallholders from seizing opportunities to sell sustainable palm oil on the market. Moreover, without reconciliation of these two sets of criteria, this could serve as a non-tariff barrier and a basis for international legal action.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Biofuels and Palm Oil: Why Palm Oil Cannot Fuel the Biofuels Industry

Mr. Bustar Maitar

Forest Campaign Manager, Greenpeace

Mr. Bustar Maitar started his presentation by stating that biofuels will remain a false solution to the climate change crisis unless the following production and sustainability criteria are met: (1) areas containing high levels of biodiversity and large carbon stocks are protected, (2) the problem of direct and indirect land use change is addressed, (3) food security is maintained, (4) crop production complies with sustainable agricultural practices, (5) social standards are met, and (6) implementation procedures and verification schemes are robust. Unfortunately, this is currently not the case in Indonesia. Mr. Maitar discussed Greenpeace's ongoing engagement with the oil palm industry and RSPO to remedy this situation.

Indonesia has roughly 88.5 million hectares of forest remaining, but is losing the equivalent of 300 football fields every hour. This makes Indonesia's rate of deforestation one of the highest in the world. With palm oil companies having a land bank – i.e. forests within their concessions –of up to 20 million hectares that can be converted to palm oil, the threat of future deforestation is grave. Out of the 6.3 million hectares of existing oil palm plantations in Indonesia, more than one million hectares were established on carbon-rich peat land releasing massive amounts of carbon into the atmosphere. Over 80% of Indonesia's GHG emissions come from deforestation and forest degradation, making it the third largest emitter in the world. Impacts of land use change for oil palm production in Indonesia are also becoming increasingly evident in Sumatra, where, for instance, tiger attacks on local community members have increased due to the dwindling amount of habitat.

Mr. Maitar posed the question, "why do certification schemes like those promoted by the RSPO fail to solve the problem of deforestation?" He illustrated his concern by showing recent photographs from the provinces of Papua, West and Central Kalimantan, and Riau, which revealed RSPO member companies actively engaged in rainforest and peat land clearance on the ground, in some cases using fire. Based on these photos, Mr. Maitar claimed that the RSPO is not doing enough to stop the destruction of Indonesia's rainforests and peat lands for palm oil. RSPO members are only a fraction of the palm oil industry; many RSPO members are not certified, and some are using the shield of RSPO to continue business as usual. Hence, while RSPO is a step in the right direction, it does not go far enough.

Mr. Maitar said that Greenpeace wants to challenge the RSPO to be more stringent. Their standards are inadequate in such areas as peat land clearance and do not exist at all on issues like maintaining carbon in the landscape. Moreover, existing standards are not being adhered to, such as in the case of United Plantations, which was certified in Malaysia while one of its branches continues to clear forests in Central Kalimantan. Because of these types of violations, Greenpeace is calling upon the RSPO to support a moratorium on the conversion of all forests and peat land for oil palm by its members – indeed, all industries – and to cancel the membership of any member that does not adhere to the moratorium. The RSPO should also lobby and promote the acceptance of this moratorium for all industries. If this moratorium is implemented, it will result in a reduced group of members, but the remaining companies will be those that hold a strong commitment to the ideals of reducing impacts on forests and climate.

Greenpeace has also expressed dissatisfaction with the definition of the term "forest," and has proposed a halt on forest conversion until consensus is reached on a definition. The organization has called for zero deforestation globally by 2020, and proposed the development of a fund financed by wealthy countries to underwrite the costs of protecting tropical forests. Greenpeace is making every effort to discuss their concerns not only with the RSPO, but also with the local and central governments of Indonesia, as well as specific companies. They are urging all relevant parties to make a concerted effort to develop better and stricter policies to avoid further loss of forests and peat lands, as well as focus on increasing yields rather than increasing the number of hectares under cultivation.

Mr. Maitar concluded by emphasizing that Greenpeace's stance is not against the production of oil palm, but rather against deforestation and peat land destruction caused by the expansion of oil palm. The environmental organization does not oppose the mission of the RSPO, despite the fact that it has chosen not to be a member, but rather thinks that it remains more effective by working from outside the organization.

PANEL 5: What Additional Steps Can Be Taken to Minimize the Environmental Impact of the Palm Oil and Biofuels Industry?

Project POTICO: Harnessing Certification Schemes to Prevent Deforestation in Indonesia

Ms. Beth Gingold

Program Assistant,
World Resources Institute

Ms. Gingold began by highlighting that there is an emerging consensus in the sustainable biofuels production arena that new oil palm plantations should be developed on degraded lands. She introduced WRI's POTICO Program, an initiative being promoted in Indonesia to gain the environmental and economic benefits of preserving forests while retaining the economic benefits of oil palm production.

Ms. Gingold outlined the highly profitable cash flow model associated with conventional palm oil cultivation. Most plantations today are developed on concessions issued by the Ministry of Forestry that are located on forested lands. Plantation companies like this arrangement because during the first four years of plantation development, income from oil palm is nil while the trees are still maturing and just beginning to produce fruit. Revenue from the sale of timber that is first harvested from the concessions thus serves to offset these start-up costs and is a significant incentive for companies to continue developing oil palm on forested lands.

One possible alternative scenario is that a scrupulous company, out of environmental or other concerns, decides to forego developing a plantation on forested land, and instead opts to do so on degraded land, despite the fact that this scenario yields no timber revenue to offset plantation development costs. This oil palm company might then be eligible to gain RSPO certification. However, it is important to recognize that certification can be a long and expensive process, requiring among many other things that a company comply with FPIC requirements. While the company might eventually receive a price premium for their certified sustainable palm oil, this premium would only be gained at a later stage, making the development of plantations on degraded land a less attractive investment. Meanwhile, the original forest concession, which the company forewent in order to develop the plantation on degraded land, could be taken over by another less scrupulous oil palm plantation or may be illegally logged, thus minimizing the environmental benefits of the company's use of degraded lands.

The idea behind POTICO, therefore, is to create economic incentives for companies to plant oil palm on degraded land, and also to make it economically attractive for them to maintain or improve management of existing forest concessions. In order to advance this program, WRI plans to identify companies that hold forest concessions that are slated for oil palm cultivation following timber harvests, and direct them to find a similarly sized piece of degraded land that can be developed into a certified sustainable oil palm plantation. WRI and collaborators are working to assist this process by finding suitable degraded land for sustainable palm oil production, where the local inhabitants are willing to participate in such a scheme. The POTICO alternative allows the company to benefit not only from palm oil production, but also allows the oil palm company to then manage the forest concession like a Forest Stewardship Council-certified forest and generate sustainable timber revenues. Another potential revenue stream could then be gained by calculating and selling the carbon savings from the sustainable management of the forest concession under a REDD project. POTICO would hopefully also generate some additional intangible benefits such as an improved reputation for the oil palm companies that participate and access to sustainable markets.

Ms. Gingold concluded her talk by stating that WRI is currently looking for potential private partner companies that would like to explore these options. One benefit is that a partnership with WRI and local organizations could help to reduce transaction costs for the certification schemes. Ms. Gingold added, though, that WRI is not insisting on this particular scheme and remains open to alternatives. For instance, WRI is willing to consider just palm oil and carbon offsets (i.e., POCO) or palm oil, conservation concessions, and carbon offsets (i.e., POCCCO) if these are deemed to work best. The expected outcome is a pilot project that will spare 100,000 hectares of forest from conversion over thirty years and set an example for others to follow in the future.

Integrating Tropical Rainforest Conservation into the Palm Oil Supply Chain

Mr. Darius Sarshar

Manager,
Sustainability and
Environmental Markets
New Forests – Asia Pacific

Mr. Sarshar introduced the Malua BioBank, the first biobank of its type in the tropics, which is managed by New Forests. Located in the Malaysian state of Sabah, the biobank aims to monetize biodiversity conservation through the sale of “conservation certificates” on the voluntary market. Although certificates can be purchased by anyone, the bio-bank is particularly suited to companies wishing to sponsor rainforest conservation, perhaps through bundling of conservation certificates with oil palm or wood products used in their manufacturing processes. The oil palm industry is one of the potential targets for sales of these certificates. Mr. Sarshar explained that this initiative’s scope is beyond the zero deforestation moratorium (ala Greenpeace) and the notion of sustainable production (ala RSPO), and aims to integrate tropical forest conservation into corporate supply chains, particularly those of agribusinesses. The company is also exploring the potential to work with RSPO in developing a more complex “compensatory mitigation credit”, a type of retrospective biodiversity offset, to help producers meet existing RSPO requirements on HCV compensation for forested areas cleared between November 2005 and November 2007 without the prior identification and set aside of HCV areas.

The Malua BioBank consists of 34,000 hectares of logged, lowland dipterocarp forest. The area has been logged twice, the most recent ending on December 31, 2007. It adjoins a palm oil plantation on the northeast, and the Danum Valley, a world famous protected area and research center, on the southern end. Malua is part of the watershed that drains into Sabah’s largest river, which provides water to Sabah’s second largest city. The forest is home to approximately sixty elephants, an estimated 650 orangutans (making it one of the most critical orangutan areas in Sabah), as well as crocodiles, banteng (local wild cattle), and many other species including the Sumatran rhino. Scientists have identified over sixteen IUCN red-listed bird and mammal species and two endangered ecosystems in Malua —lowland dipterocarp and the freshwater swamp ecosystem.

In 2008, New Forests signed a fifty-year contract with the Government of Sabah to take over a long-term conservation lease for the area and create the Malua BioBank. This area was under threat of further logging and conversion to palm oil. The plan is to invest USD 10 million over a six-year period to restore, conserve, and protect the area. The organization’s objective is to commercialize the biodiversity value through the sale of biodiversity certificates, compensation credits or carbon credits. Twenty percent of the gross revenue will be used to endow a permanent trust fund, managed by trustees of the Hong Kong Shanghai Banking Corporation, which will fund the conservation of the area in perpetuity. New Forests estimates that this endeavor will generate between USD 5-10 million for the trust fund, which will be used in Malua. If the Malua Biobank contract is not extended beyond the first fifty-year period, the funds could be used to support conservation work elsewhere. The Malua Biobank is managed by a steering committee, which includes representatives from the Sabah Foundation (the holder of the logging license over Malua), New Forests, and the Sabah Forestry Department. There is also an independent advisory committee that consists of NGOs and scientific experts serving a dual purpose of independent, external scrutiny and providers of technical input into the conservation and management of the area.

The Malua Biobank was designed emulating the model used in the US. Biobanks there were established in order to help developers meet compliance obligations under the Endangered Species Act and the Clean Water Act, which dictate that developers must buy credits from biobanks to mitigate or compensate for unavoidable residual impacts (after avoidance and restoration alternatives have been exhausted) associated with damaging land uses, such as agriculture or real estate development. There are over 800 biobanks (as well as wetland mitigation and endangered species banks), most of which were started in the early 1990s. The market is in the low billions USD (compared to the USD100 billion for the emerging carbon market), but is seen as a highly effective compensation mechanism. The benefit of biobanks is that they are a cost effective and easy mechanism for developers to mitigate and compensate for their impacts. The biobanks are managed by conservation specialists, not developers, ensuring that biodiversity benefits are realized. Of particular relevance to conservation is the fact that these initiatives allow the pooling of protection and restoration offset activities over large landscape-level areas, rather than fragmented pockets of habitat that have smaller ecological value. It also enables the achievement of a net of “no biodiversity loss” by compensating an unavoidable loss in one area in another area, or even a net of conservation gain.

According to Mr. Sarshar, the main markets for the Malua biobank are the palm oil, biofuels, and consumer products industry that use palm oil. Biobanks offer these industries a potentially transformational marketing strategy. New Forests, for instance, is proposing to companies that for every ton of CPO they produce, they buy and retire one certificate, which protects 100 square meters of forest. The spot price of a ton of CPO is in excess of USD 1,000 on the market, while the cost of one certificate is USD 10 or about 1% of the price of CPO. Hence, the more palm oil that one purchases, the greater the extension of rain-forest that will be conserved. This would help change the stigma that oil palm is inherently destructive. The second potential market is the RSPO, which requires that a company seeking certification, but was involved in forest conversion between November 2005 and November 2007, offset those loses. The RSPO is currently reviewing options for putting that policy into practice and New Forests has proposed that they accredit biobanks which can sell credits to companies that want to compensate for that historic conversion.

Mr. Sarshar concluded by highlighting that biodiversity is critical, and that assigning a commercial value to its conservation might be an extremely effective mechanism to attract private capital to conservation, which is currently, inadequately funded by philanthropic and public sector sources. In his view, this could be an exciting development in the tropics and should be replicated in other areas should it prove to be successful.

Closing Remarks

Mr. Javier Mateo-Vega

Director,
Environmental Leadership & Training Initiative - ELTI

Yale School of Forestry & Environmental Studies
Smithsonian Tropical Research Institute

Mr. Mateo-Vega provided a summary of the key issues discussed during the two-day conference. He began by highlighting that biofuels tend to fare better in terms of GHG emissions than other sources of energy derived from fossil fuels. But the most readily available types of biofuel feedstock, including palm oil, have the potential to generate much higher aggregate environmental costs and impacts depending on where and how they are produced. Even though palm oil-derived biofuels currently account for only a small percentage of energy demands on a global scale, and even though palm oil plantations account for a very small fraction of all agricultural land, its production is already generating significant land transformations, both directly and indirectly, including the loss and degradation of critical tracts of tropical forests.

It is very likely that the demand for biofuels will continue to increase. A surge in feedstock production would not only generate greater direct impacts on tropical forests, but also potentially compound a long list of already existing land use pressures that are affecting the integrity and viability of these ecosystems. In other words, synergistic impacts on forests are likely to increase. It should be noted that efforts to improve yields, and thus reduce the need for expanding areas under oil palm cultivation, are underway. However, there is sufficient evidence that oil palm production continues to expand into biodiversity-rich and sensitive areas such as peat lands. The implications are not only the loss of biodiversity but also the release of massive amounts of carbon into the atmosphere. Also, biofuels production inherently creates winners and losers. Unfortunately, customary rights to lands are not always recognized and cases of human rights abuses by oil palm companies have been recorded. There is a need for valuing the rights of local communities and indigenous peoples, which entails careful monitoring, mitigation, and adequate compensation in worst-case scenarios.

Fortunately, there are a number of promising schemes under development which have the potential to enable the transition towards more sustainable methods of production. Methodologies, guidelines and programs have been developed to encourage cultivation in areas that are appropriate for feedstock production, such as the RCAs proposed by WWF, POTICO proposed by WRI, and the sustainability standards promoted by the RSPO. Also, novel mechanisms and strategies for the tropics, such as REDD and biobanks, might create incentives to avoid cultivation on forested areas or mitigate the biodiversity im-

pacts of biofuels production. Biofuels derived from microalgae, for example, also have the potential to partially diffuse land transformation pressures in the tropics.
Overall, we must strive to ensure that biofuels production meets environmental and social sustainability criteria, and that it demonstrates technical feasibility in addition to profitability. Certification schemes, such as RSPO, are indeed a necessary step forward and present themselves as potential transformational mechanisms for the industry, but there is still plenty of room for improvement in their development. The fact that they are voluntary schemes, pose potential problems. Alternate approaches, such as those employed in California, highlight the value and power of well-directed regulation. It is important to note that the certification systems and regulatory schemes for biofuels are relatively new and over time, through the incorporation of lessons learned and adaptation, may be able to fulfill their potential.

In closing, there needs to be more discussion surrounding market and regulatory problems given that sustainability standards and certification systems, such as RSPO, cannot entirely compensate for government or market failures. Also, regulatory and certifying bodies are placed in a challenging position when they attempt to control their constituencies while simultaneously promoting the industry, creating conflicts of interest that can discredit these types of efforts. If the biofuels industry fosters open and transparent dialogues regarding these issues and responds to critical challenges in practice, there might be a future for sustainable palm oil in the energy market after all.

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Glossary of Terms

Agribusiness
Industry relating to the business of modern food production, including farm operations, supply, and equipment distribution.

Agrochemicals
A broad term for synthetic chemicals used in agriculture, including fertilizers and pesticides.

Albedo
The power of a surface to reflect light that falls upon it. Light colored surfaces reflect more light than dark colored surfaces. The changed albedo of land use surfaces can have a significant impact on climate change.

Biomass
Biological material derived from living (or recently living) organisms, often plant matter which can be used to generate energy.

Carbon debt
Also known as payback time, this term refers to the amount of time it will take for the carbon reductions resulting from the usage of biofuels to offset the increased carbon emissions resulting from land use changes required to grow the biofuels feedstock.

Carbon trading
Any mechanism in which carbon credits, i.e. a reduction in carbon emissions, are sold by the producer of the carbon credits to another party, whether it be to offset their own emissions or as a financial investment.

Cellulose
An organic compound that is the primary structural component of cell walls in plants. The compound has human industrial value for the production of paper, textiles and other commercial products, and is also the main combustible component in crops used for energy production.

Clean Development Mechanism
A mechanism created as part of the Kyoto Protocol that allows Annex 1 countries (i.e., those industrialized countries and countries with economies in transition that have obligations to reduce

or minimize their GHG emissions) to invest in projects that reduce emissions in developing countries as an alternative to more expensive emission reductions in their own countries.

European Union (EU) Renewable Energy Directive
A directive put in place by the EU in 2009 to increase the amount of renewable energy in the bloc's energy mix from the current level of 8.5% to 20% by 2020. This applies to energy used in the electricity, heat, and transportation sectors. Each member state can decide the most suitable mix of renewable energy sources to meet its target.

Eutrophication
The addition of nutrients, particularly nitrates and phosphates, through pollution to aquatic systems, which may lead to a bloom of phytoplankton and depletion of oxygen in the water.

Evapotranspiration
A term combining "evaporation" and "transpiration," which describe the transport of water into the air from plant and soil surfaces.

Feedstocks
Raw crop material used for industrial processes or converted into biofuels and bioenergy. Seeds and grains are examples of these raw materials that are utilized for resources like sugars, oils, and cellulose.

Free, Prior & Informed Consent (FPIC)
A principle ingrained in international law that holds that indigenous peoples should be able to grant or withhold their consent to projects proposed on their customary land

First Generation Biofuels
Fuels derived from feedstock sources that could otherwise enter the animal or human food chain. These fuels are commonly made from starch, sugars, animal fats, and vegetable oil.

Forest Stewardship Council
Non-profit organization whose goal is to coordinate the development of forest management standards throughout the world. Offers

independent third-party accreditations and evaluates both forest management activities and the tracking of forest products.

Greenhouse Gas (GHG) Emissions
Radiation emitted by gases present in the earth's atmosphere including water vapor, CO_2, methane, nitrous oxide, and ozone. These gases have differing emission levels based on both molecular characteristics and concentration levels. Their natural and anthropogenic sources have varied over time.

Jatropha
A plant genus that contains a number of trees and shrubs that yield oil-bearing seeds which can be used for making biofuels.

Kyoto Protocol
An international agreement adopted in 1997 as part of the United Nation's Framework Convention on Climate Change (UNFCCC). In that agreement, which went into effect in 2005, 37 states, consisting of highly industrialized countries and countries in the process of transition to a market economy, agreed to legally binding emission limitation and reduction commitments that have to be enacted during the 2008-2012 commitment period, representing a 5.2% reduction in GHG emissions levels relative to 1990 levels.

Leakage
Within the context of Reducing Emissions from Deforestation and Forest Degradation (REDD), this refers to displacement of land use activities resulting in GHG emissions to other locations outside of the project area.

Life Cycle Analysis
A procedure used to assess all impacts of a product, including those associated with the extraction/harvest of raw materials, processing, manufacture, distribution, use, all the way through to the disposal or recycling of the end product.

Neutraceutical
A food or food product that has both nutritional and pharmaceutical value, including those used for the prevention and treatment of disease.

Peat Swamp Forest
Tropical moist forest type that develops in areas where dead vegetation is waterlogged, keeping leaves and wood from completely decomposing. This biomass accumulates over time into a thick layer of peat. This forest type is particularly prevalent in parts of Sumatra and Borneo, but is also found in parts of Africa and South America.

Reducing Emissions from Deforestation and Forest Degradation (REDD and REDD+)
REDD is a mechanism to use market or other financial incentives to reduce GHG emissions from deforestation and forest degradation. REDD+ expands the scope of eligible activities to conservation, sustainable management of forests, and enhancement of carbon stocks.

Responsible Cultivation Areas (RCA)
Program of Ecofys, World Wildlife Fund, and Conservation International to identify degraded areas of land where biofuel production can be grown with minimum direct and indirect impacts on the environment and local communities.

Roundtable on Sustainable Palm Oil (RSPO)
The RSPO is a voluntary, multi-stakeholder group started in 2003 with a mission to provide certified sustainable palm oil to the market in a clear and transparent manner.

Roundtable for Sustainable Biofuels (RSB)
An international forum designed to connect farmers, companies, nongovernmental agencies, governments, and inter-governmental agencies interested in ensuring sustainable biofuel production and processing.

Second Generation Biofuels
Fuels derived from feedstock sources that are the non-food components of crops, such as stems, leaves and husks, as well as other non-food materials like switch grass, wood chips, and fruit pulp from pressings.

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